SCIENTIFIC AMERICAN

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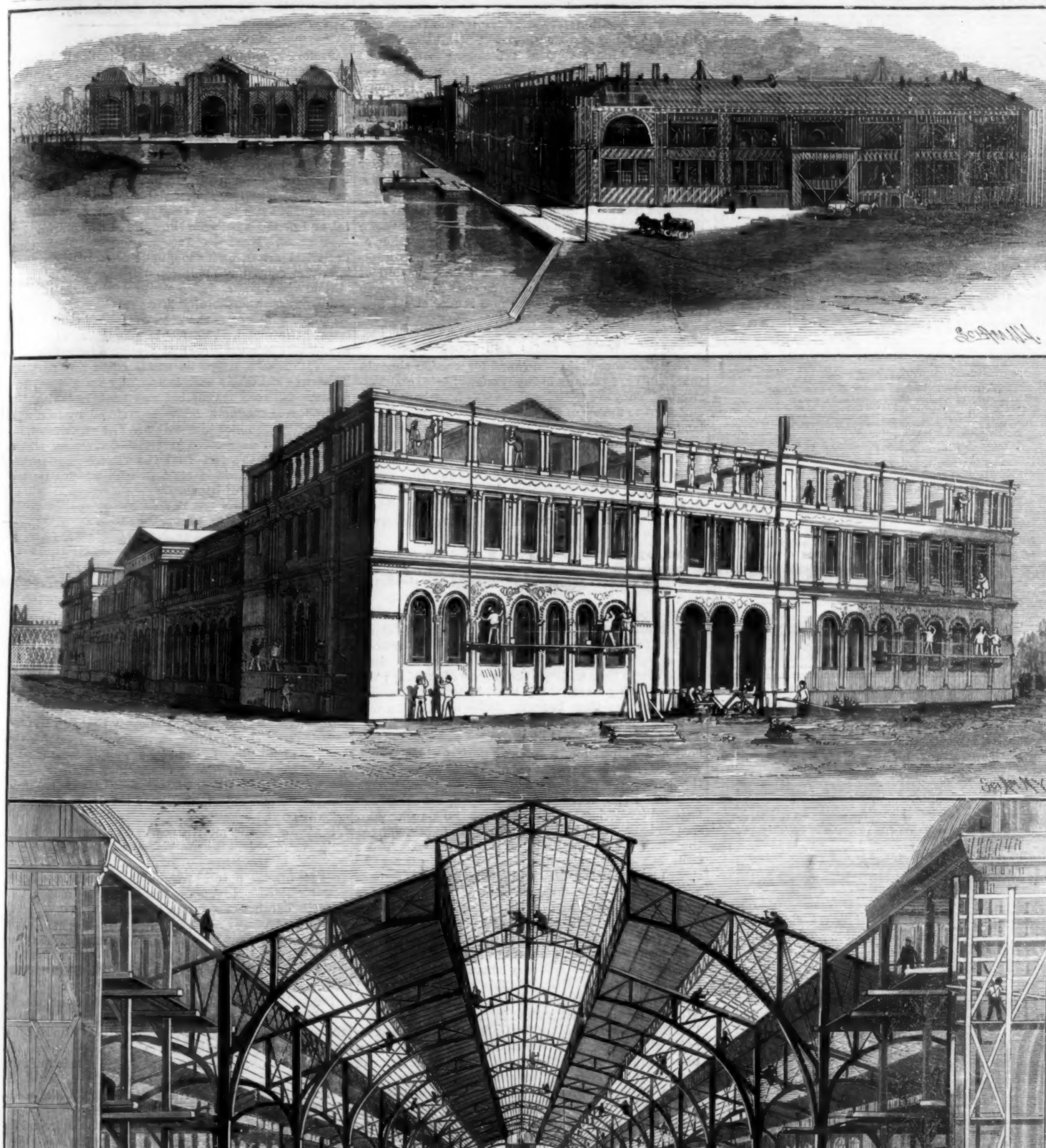
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXVI.—No. 2.] ESTABLISHED 1845 NEW YORK, JANUARY 9, 1892. [$3.00 A YEAR. WEEKLY.



1. The Woman's Building, substantially completed. 2. The Mines and Transportation Buildings, in a well advanced state. 3. Interior of the Mines Building.

PROGRESS OF THE WORLD'S FAIR BUILDINGS, CHICAGO.—[See page 23.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors
PUBLISHED WEEKLY AT
No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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One copy, one year, for the U. S., Canada or Mexico.................. $3 00
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MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

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NEW YORK, SATURDAY, JANUARY 9, 1892.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 836

For the Week Ending January 9, 1892.

Price 10 cents. For sale by all newsdealers

ROOM STILL FOR THE TROLLEY.

Reports that a novel and practical system of electrical railway, invented by Mr. Edison, and alleged to be superior to all others, was about to be introduced have caused much annoyance to the promoters of the trolley system; many street railway companies ripe for a change to the trolley countermanding their orders and postponing their plans, and town and village authorities declining to sanction changes from horse to trolley till the value of the new system could be ascertained.

With commendable diligence Mr. Edison has described for public information the field which he proposes to cover. He has authorized the statement that the new system is designed exclusively for roads of heavy traffic, in large cities, where the expense of the original installation is warranted by the traffic, and where the trolley system will not be permitted. "The new system," the statement continues, "will not be applicable, in a commercial sense, to long roads operating less than fifty cars simultaneously. It must, therefore, be understood that, outside of the large cities, the best system that can be advocated is the trolley."

This statement will doubtless give much relief to the trolley people, not, however, because of fears on their part that he would supplant their system with something better, for it cannot be said, once apprised of his proposed method of application, they entertained such fears, but the admission on such high authority that a portion, indeed, it may be said the major portion, of the street railway field, notably that pertaining to interurban traffic, is yet within the legitimate domain of the overhead trolley motor, is calculated to remove aldermanic doubts and loosen and render street railway managers again complacent.

WOODEN SHOES AND CLOGS.

There is a considerable demand for wooden shoes in this country, especially in the Western States and Territories. They are worn by those who have become accustomed to the use of that kind of foot covering in the land of their birth and have not yet adopted the shoes generally worn here, and they are also used by persons who are employed in damp, sloppy places. Workers in tanneries, dyeing establishments and chemical works find them a better protection for the feet and more comfortable than shoes made of leather or india rubber. They are also worn by women when doing their scrubbing, and also on wash days.

The largest manufactory of wooden shoes in the United States is located at Grand Rapids, Michigan, and there are two similar establishments in the same city.

The products of these factories are shipped to nearly every State in the Union and to various points along the Pacific coast. The shoes are made from basswood logs sawed into suitable pieces for the various sizes. These blocks then undergo the process of shaping; the tool used being a very sharp, short-handled carpenter's ax. They are then brought under a trimming tool fastened into a block not unlike a butcher's block. The last-named tool, or knife, is about two to three feet long and shaped like a cooper's paring knife. Some workmen acquire a great deal of skill in manipulating the shoes, and the process of manufacture attracts visitors. After being properly shaped, the shoes are fastened for boring the cavity, which is done with odd-shaped tools, very sharp, and which are imported from the Netherlands especially for this purpose. These tools can only be handled successfully by the most skilled workmen. After shaping and boring the shoes are rubbed with sandpaper and in some instances polished. Some wooden shoes are made to order in most elaborate style, being engraved or painted and made very light in weight.

A good workman is able to produce from ten to twelve pairs of the ordinary shoes per day, and the principal factory at Grand Rapids has made between ten and twelve thousand pairs during the past year. Wooden shoes are not packed in boxes for shipment, like those made of leather, but, after joining them in pairs with twine, they are strung on sticks, a dozen pairs together, each lot bearing a tag with the name of the person to whom they are consigned.

The wholesale price for the ordinary shoes is $3 per dozen pairs, while the small sizes vary from 15 to 20 cents per pair, and there is also a common grade of toy shoes which sells at the last named price.

Clogs are made at a number of places in this country. One family in Philadelphia, five in number, including boys and girls, are expert makers of these articles. Clogs, which are known also as pattens, are wooden soles to which shoe or boot uppers are attached. In the midland counties of England large quantities of them are produced. There the sole and heel are made of one piece from a block of maple or ash which is two inches thick and a little longer and broader than the desired size of shoe. The outer side of the sole and heel is fashioned with a long chisel-edged implement called the clogger's knife or stock.

With another instrument a groove is made about one-eighth of an inch deep and wide around the side of the sole, and by means of still another tool, called a hollower, the contour of the inner face of the sole is adapted to the shape of the boot. The uppers of heavy leather, machine sewed or riveted, are fitted closely to the groove around the sole, and a thin piece of leather binding is nailed all round the edges, the nails being placed very close in order to give a firm, durable fastening. These clogs are also worn by people whose calling brings them into damp places.

Expensively made clogs are in demand. These have finely trimmed soles and fancy uppers, while there are clogs used by dancers on the stage which cost from $2.50 to $6 a pair.

The towns of Mende and Villeport are centers of wooden shoe manufacturing in France, and here about 1,700 people find employment in this industry.

Liquid Oxygen is Magnetic.

Professor Dewar has lately made a highly interesting communication to the Royal Society. Faraday, more than forty years ago, proved that oxygen alone among known gases is magnetic, and Professor Dewar sought to determine what effect a temperature of 180 degrees C. below zero would have upon its behavior in the magnetic field. Having previously ascertained that liquid oxygen does moisten or adhere to rock crystal, and consequently maintains in contact with that substance a perfect spheroidal condition, he poured the liquefied gas into a shallow saucer of rock crystal, and placed it between the poles of a powerful electro-magnet. He expected some such result as the total or partial arrest, under magnetic stress, of the violent agitation caused by ebullition of the spheroidal mass. But on the magnet being excited, the whole mass of liquid oxygen was literally lifted through the air and remained adherent to the poles until dissipated by the heat of the metal. The feeble magnetism of oxygen at ordinary temperatures had become a force to which no solution of a magnetic metal offers any parallel. Thus was strikingly and beautifully exemplified the relation between magnetism and heat, of which the entire loss of magnetic qualities suffered by iron at a red heat is a familiar illustration. The experiment, interesting and suggestive in itself, derives an added interest from the fact that the electro-magnet employed is the historic instrument with which Faraday carried out many of his classic investigations.

A New Power Wanted.

A writer in the *Sewing Machine News* is not satisfied with steam or the more recently adopted electric power, and wants somebody to invent something better. It will be done. The atmosphere is full of electricity, and, when overcharged, relieves itself in thunderstorms, and as these storms occur in hot weather, it would go far to prove that heat is at the bottom of it, and, if such be the case, why could we not devise some plan to produce and concentrate it at once by the use of gas or coal oil? That lightning has an affinity for coal oil is shown by the number of times large tanks are destroyed by it. The man that can devise some means for operating a motor cheaply that can be used in both city and country, can take his ease for the balance of his life. It would be well if some genius would turn his attention to something outside of the beaten paths of steam and electricity, and see if, in looking for one object, he is not overlooking another equally good.

Since air is the motive power that keeps so many animate machines in motion, why should it not be brought in use to move inanimate ones? We know that air presses a ton's weight upon every foot of exposed surface. Now, if we could, by some means, mechanical or otherwise, exhaust that air from one end of a cylinder having a square foot of exposure, we should have a ton's pressure upon anything filling the cylinder, which would force it to the end, and if this could be repeated at the other end, we should have the action of the piston of the steam engine reproduced.

Since the first steam engine owed all its efficacy to atmospheric pressure, would it not be well to see if the same means cannot be devised to utilize air, not in a compressed form, but by exhaustion at one end of the cylinder or in some other manner? If this could be done, either mechanically or otherwise, it would displace all other modes of transmitting power and could be used as well on the desert as in the city.

In the rush after electric motors, let us not lose sight of the fact that electricity is only one of the many physical forces by which we are surrounded, and that all such forces must be artificially excited.

Remedy for Whooping Cough.

Common thyme, which was recommended in whooping cough three or four years ago by Dr. S. B. Johnson, is regarded by Dr. Neovius (*The Lancet*, May 9, 1891), as almost worthy the title of a specific, which, if given early and constantly, invariably cuts short the disease in a fortnight, the symptoms generally vanishing in two or three days. He gives from one ounce and a half to six ounces per diem, combined with a little marshmallow sirup. He never saw any undesirable effect produced, except slight diarrhœa. It is important that the drug should be used quite fresh.

The Protection of Residences from Bacteria.

BY FREDERICK BAUMANN, IN THE "BUILDING WORLD."

The whole philosophy of medical science has of late been subverted through the gradual discovery of the extensive species of minute beings called bacteria—the lowest order of beings known to exist. They were once believed to be the product of a *generatio æquivoca*—of spontaneous generation—until it was made evident by Pasteur that they are generated *ex ovo*—from the egg. Philosophers have, however, then subsequently not abandoned faith in spontaneous generation, from the original elements upward, but have put the bacteria up as a rather composite race of beings, made up from many millions of molecules, and established a belief in a class of organic beings as progenitors, as it were, of the bacteria, which beings are said to be many times simpler in their composition and smaller than are the latter, and so minute in size that they will forever be hidden from human sight. All diseases and ailments of the human system are, in accordance with an overwhelming number of medical philosophers, owing to encroachments thereon by bacteria, as destroyers of blood and tissue.

Some twenty-five years ago Professor Naegeli mentioned some very interesting and, as I believe, important experiments as to the life of the lowest orders of fungi, of which our bacteria are the lowest yet. He prepared a proper neutral nourishing fluid, and put therein the seeds of mould fungi, fermenting fungi, and bacteria. The result was that the latter exclusively went on to multiply at the expense of the nourishing fluid, so that not a trace of the other two kinds of fungi could be found. He then added 1 per cent of tartaric acid to a fresh dish of nourishing fluid. The result now was that the fermenting fungi had the field for themselves exclusively. A third experiment, with 5 per cent of the acid added to the fluid, gave the field to the mould fungi. Singly, each kind of fungi would grow in either kind of nourishing fluid, but in competition with each other the field was conquered by one kind exclusively.

Arguing from this fact, Naegeli justly asserts that the blood corpuscles, as principals within their nourishing fluid, ever prevent the growth therein of other fungi, which are constantly inhaled with the air, thus coming in direct contact with the blood of the lungs. The blood corpuscles ever do this so far as they are in sound condition. But, alas! they are often weak and often subject to debilitating effects, so that the foreign fungi get a chance to grow and multiply, so rapidly, indeed—doubling their number within every few minutes—that within a few hours the blood's life, and therewith the life of the being, may be destroyed.

Within the child there flows and grows the blood of its parents, and all the latter's ills and ailments that human flesh is heir of accompany the child. The German student expresses this in the jocular statement that every man "should be most careful in the selection of his parents."

A birthplace of bacteria is below the ground, nearest the level of ground water. As the water recedes, the fungi get dry, and slowly rise with the ascending air current to the surface and into the atmosphere, there to be, by chance, inhaled. Assuming a grain of fine sand to be 1-200 of an inch in diameter, the number of grains per cubic inch is 8 millions; further, assuming the interstices between grains at one-fourth, we may safely count 32 millions of interstices as taking up the entire space of a cubic inch. A single interstice may thus contain: Thirty grains of sand dust = 600 blood corpuscles = 24,000 microbes. A single microbe, of medium size, may, therefore, very conveniently ascend within a body of even the finest sand, within the pores of rock, of brick, mortar, and concrete. It finds no sort of impediment in any dry substance excepting dense clay, so far as it is not wholly dry.

Such clay protects, as is substantiated by the following account of Dr. Pohl: A country gentleman had on his estate seven one-story houses inhabited by laborers. These houses were dilapidated and dirty. Their floors were a sort of concrete, made of clay. The houses were doomed to be destroyed, to make room for commodious tenements of a better class. At a time when cholera visited the place, five of the houses had been renewed with floors raised from the ground, which had been deprived of the layer of clay; two were in their previous condition. The disease laid up 18 of the inmates of the new and improved, ostensibly far more sanitary, houses, and none at all of the two rotten and dirty houses. The result could only be attributed to the fact that the clay floors had effectually prevented any preparatory disease germs to rise within those houses.

I have at last arrived at my task proper. Bacteria are at all hours generated in the soil under our very homes, they rise, and are inhaled by us as the inmates. Among them there may at any time be some of the kind which cause disease, which might or might not grow at the expense of our blood, as circumstances beyond human control would govern. The upward current, which brings them to us, is augmented in winter, as we well know, by the reverse of temperatures. Where human well-being and life are considered worth anything, there the architect of the present day should, without fail, pay due attention to such construction of a residence building as would fairly warrant a protection against all ascending air currents ever present under its floors and in its walls. The task is neither difficult nor expensive, as we shall see, and no excuse can effectively be offered on this score.

Common materials most likely to be proof against penetration of microbes are: asphaltum, glass, and pitch tar. The asphaltum to be had in form of pressed plates. All these materials can be most readily had and employed. Asphaltum or glass, in two layers on proper mortar, to be put in all walls at the level of lowest floor. Asphaltum also to be put against exterior walls, terminating below lower water table. Concrete, with level surface, established on the entire ground, to be covered with a coat of pitch tar and tarred felting, which may be repeated once or twice, to be lastly covered with a proper layer of finish concrete. Where wooden floors are required, the finish concrete may contain the required sleepers. Where desired, a further protection can be had by spreading a sheet of lead under the furnace stand prior to making the last concrete. Even the entire surface of basement may thus be advantageously covered, where expense is no objection.

These arrangements, carefully executed, are unquestionably calculated to produce the nearest positive impregnability of floor and walls of a house, though we must conceive it as next to impossible to give absolute evidence as to such effect. We must rest our assurances on the degree of impregnability of the substances employed and on the accurate manner of their employment. The arrangement excludes the use of iron sewers and requires all water supply pipes to be suspended from the basement ceiling. Return pipes of a steam heater, and cold air ducts, must likewise be thus suspended. Iron sewer pipes are objectionable for several reasons. Iron is a bad material to be put under ground. It decays. The decay is augmented by the acids of the liquids within the pipes, and the flow is impeded by rust. Arrangements for cleansing are, therefore, provided at short intervals. Earthen sewers, on the other hand, if well made, are of the most enduring material within our mechanical province, and should not be rejected because they are generally so bunglingly applied by our mechanics. Good sewering requires the excavation of all trenches at one time, and a concave concrete foundation on a gradual and even pitch for all sewers. The sections should be laid in mortar of Portland cement, and connected by means of metallic rings, which will insure permanency. The receiving ends should be fully turned up, and have a socket in which is fitted an iron member receiving the soil or the waste pipe, both being provided with a tight slip joint. The joints within the socket to be tightened with a mixture of asphaltum and sulphur. Provisions thus properly made, with due care and foresight, are unquestionably calculated to secure residence buildings in a desirable measure against the encroachment of those invisible beings which are the ever-present and most persistent enemies of the human race.

The Vicissitudes and Perseverance of an Inventor.

Patents extraordinary in character and history are becoming alarmingly frequent, but we must preserve a unique position for one which has just been granted to Mr. George F. Green for an electric railway. The daily papers have within the past few days given somewhat sensational accounts of his inventions. The facts are these, as related in the *Electrical World:*

Mr. Green has been for many years a resident of Kalamazoo, Mich., earning a livelihood as a working mechanic, and filling up what small spare time his trade allowed in the study of electricity. Years ago, in fact as early as 1856, shortly after the striking experiments of Page had drawn attention to electric traction, Mr. Green, like others of his countrymen, was impressed with the importance of the subject, and spoke of it to his neighbors. In 1875 he was enabled to put his ideas into practice on a small scale, and constructed a little track on which to run a train of cars drawn by a motor of his own construction, which was supplied by current from storage batteries through the medium of the rails as conductors. Later, in 1879, another and larger model was constructed capable of embodying the same ideas. The inventor fully appreciated the advantages of the dynamo for the purpose of supplying current, but he was poor and no dynamo was available. In fact, in 1879 he was compelled to act as his own patent attorney, and the claims which he then put in were technically informal and hence encountered many obstacles in the Patent Office; interferences were declared and his application—even after an appeal to the Commissioner of Patents—was finally rejected. Not discouraged, however, and firm in the belief of his priority, the inventor carried the case to the Circuit Court of the District of Columbia, the final legal resort after an adverse decision by the Commissioner. It, after reviewing the evidence, passed favorably upon his application; and, pursuant to the decision of that court, two patents were granted on December 15. The claims of both these patents form, indeed, an interesting chapter in the history of electric traction.

Although similar ground had been covered in the days when the primary battery was the only available source of electricity, Mr. Green's work was done long before the final impulse had been given to electric traction by the researches of Dr. Werner Siemens and contemporaneous inventors in this country. It forms the connecting link between the old and the new in the history of the application of the motor to railway service, and whatever its value as a patent may be, as a contribution to our history the documents granted a couple of weeks ago possess no small importance. The work of the pioneer is difficult, especially when it is hampered by poverty, and it is hard to give too much credit to those persistent inventors who, in the face of all sorts of obstacles, have carried through their first crude ideas to working success. With more money, or more influential friends, it might have been Mr. Green's fortune to carry out such an experiment as a few years later in Berlin drew the attention of the world to the possibilities of the electrical distribution of power in facilitating rapid transit.

Cost of Power from Small Motors.

In the SCIENTIFIC AMERICAN SUPPLEMENT for this week, No. 836, we give a translation from the *Journal des Usines a Gaz* of a report on this subject made by M. Korte to the Association of German Engineers. The following is an extract from this report:

"M. Korte goes to the very bottom of the details, and as a result the figures are evidence of the carefulness of the examination and of the comparisons that were made. We do not now recall to mind that any other published treatise contains such complete summarized statements of the cost to the user of the four named classes of motors treated of, and have no hesitation in saying that M. Korte's tables will command widespread notice in this country. To the gas engineer they are particularly interesting and full of promise, for they show quite plainly that with well-directed effort on his part the field for small motors should be practically at the mercy of the product that he manufactures. One striking feature of the tables that nominally is against the gas motor is the greater first cost of apparatus and installation. From his compilation we find the following, taking the one horse motor in each class as our specimen:

	Gas Motor.	Hydraulic Motor.	Electric Motor.	Compressed Air Motor.
Total cost of establishing plant	$408.68	$226.20	$139.44	$237.14
Cost to operate 3,000 hours	147.98	467.11	561.62	460.71

"But while this excess will act toward causing in the mind of an intending power user an unfavorable first impression, a glance at the totals respecting the annual cost of running each motor 3,000 hours per annum ought to convince the investigator that the gas motor at an expense of $408.68 for first installation was the cheaper instrument at the end of the first year for him by $144.40 than had he installed an electric motor at a first cost of but $139.44, the saving meanwhile having accrued from the difference in cost of operating the machines. In his second year of use, however, the economy will amount to a clear gain of $413.64, and that will be kept up in following years. The reduction of the figures from foreign to American equivalents involved a great amount of labor, and we doubt not that the enterprise which prompted the work will be appreciated by our readers."

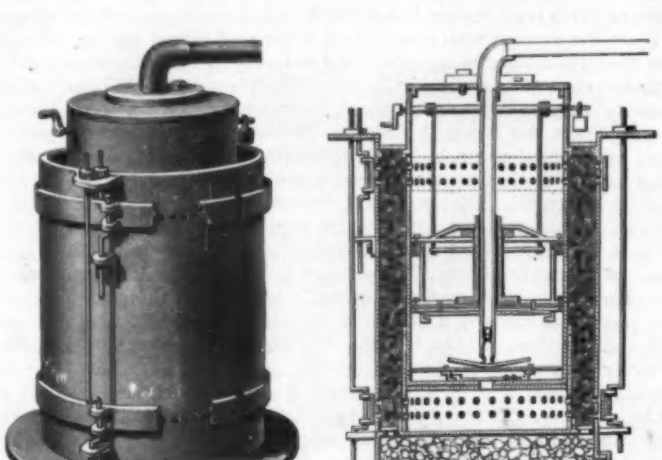
THE Bureau of the American Republics announces the discovery of vanadium minerals in considerable quantity in the province of Mendoza, Argentina. Vanadium is one of the rare elements for which there is a limited demand, and commands an exceedingly high price, being quoted, so says the *Engineering and Mining Journal*, at $22 per gramme at present (over $700 per ounce). It is used chiefly in the form of ammonium vanadate, as a dye stuff, producing, in conjunction with aniline, the most absolute black known to the dyers and calico printers. It is similarly used in the manufacture of certain kinds of black ink. The amount required for these purposes is, however, extremely small.

The vanadium minerals are widely distributed, although seldom found in large quantities. The ores in certain districts of Arizona contain a considerable amount of vanadate of lead, and there has been some talk of saving the mineral as a by-product, but the present demand for the vanadium salts being so limited it is doubtful if such an undertaking would be worth while.

The manufacture of vanadates is in the hands of two or three houses in Great Britain and on the Continent. The price is kept high, because the consumption is so small, and because any serious competition, increasing the supply, would destroy all the profits of the business. Under these circumstances, present uses will have to be greatly extended or new ones developed before vanadium ores will acquire much value. All that can well be done with them at present is to sell them to the manufacturers who monopolize the industry, and a very small amount will satisfy that possible demand.

A DEVICE FOR RAISING LIQUIDS.

The accompanying illustration shows a perspective and a sectional view of a device for raising water from wells, rivers, etc., or for raising other liquids, as may be desired. It has been patented by Mr. Carl Storla, of Belford, South Dakota. The central cylindrical casing has a bottom aperture covered by an upwardly opening valve held in an open frame, the lower end of an upwardly extending discharge pipe being secured on a bar of this frame. The pipe has side openings at its lower end, through which water passes from the casing into the pipe, there being also in the pipe a valve to prevent water and air from rushing down when the piston is raised, the pipe extending centrally through a vertically movable piston. This piston is adapted to press on the water in the lower part of the casing, and is raised by ropes winding on a windlass in the upper part of the casing. The piston is adapted to be weighted by suitable material, as stones, etc., or with water, which may be allowed to enter at higher openings, there being a valve in a false bottom of the piston to allow of the escape of the water as the piston is raised. The lower part of the main casing fits into and is supported in a second casing, the lower end of which rests on a plate formed with an outer shell, and forming a space adapted to be filled with filtering material, there being below the plate a base loaded with stone to hold the device in position where it is used in a lake or river, although this is not necessary when it is used in wells. When the piston is held in an uppermost position by the ropes wound upon the windlass, water passes through the lower openings and through the valve in the bottom of the central casing; the operator then lowers the piston, by turning the crank arm of the windlass, and, when the piston reaches the level of the water, the crank arm is released, so that the piston presses by its own weight upon the water, forcing it into and through the discharge pipe. When the piston has reached a lowermost position, the water in the central casing has been nearly all expelled through the discharge pipe, and the piston is again raised by winding up the ropes on the windlass.



STORLA'S DEVICE FOR RAISING LIQUIDS.

AN ELECTRIC CARRIAGE.

The graceful vehicle illustrated in the accompanying picture is interesting, as being undoubtedly the first carriage propelled by electricity built in the West. It is the invention of William Morrison, of Des Moines, Ia., and was built by Morrison & Schmidt, of that city. It is intended for operation on ordinary city and country roads, and will carry twelve people comfortably, although the inventor says that it could be easily arranged for double that number.

The power is furnished by 24 storage battery cells placed beneath the seats. These accumulators are of Mr. Morrison's own design, and he claims to have produced a battery that cannot be considered an infringement on other accumulator patents. He says that the combined output of the cells is equal to 112 amperes at 58 volts. Each cell weighs 32 pounds, making the total weight 768 pounds. The cells are charged without being removed from the carriage, the process taking ten hours. It is proposed to do this at night.

This motor is of four horse power, although, on a pinch, it is claimed that it can be worked up to eight horse power. It is of the ordinary street car type, with a Siemens armature, but Mr. Morrison claims an improved method of winding, by which the replacing of burned-out armatures is greatly facilitated. As will be seen by the illustration, the motor is sustained by a framework underneath the body of the carriage, and is geared to the rear axle.

The steering apparatus is attached to the forward axle and is controlled by a hand wheel in the front of the carriage. It is claimed that this attachment has been perfected to such an extent that a light touch on the wheel will alter the course of the vehicle. The motor is thrown in and out of circuit by a switch placed in the forward part of the carriage and intended to be moved by the foot of the person guiding the movements of the vehicle. Thus one person is enabled to control the speed of the carriage and steer at the same time. No rheostat is used, the speed of the motor being regulated by the number of cells cut in or out.

Mr. Morrison claims that his carriage has been exhaustively and successfully tested in Des Moines, and that it has been run continuously 13 hours, attaining a speed as high as 14 miles an hour. He thinks that a much higher velocity can be attained if desirable. The carriage is to be soon exhibited in Chicago by Harold Sturgis and John A. Qualey, so says the *Western Electrician*.


AN ELECTRIC CARRIAGE.

Difference in Eyes.

Mr. James Shaw writes to *Nature* as follows: "I labor under the peculiar inconvenience of having a right eye of normal power and a short-sighted left eye. The numerals on the face of a clock five-eighths of an inch high are visible to the right eye at twelve feet distant; but in order to discern them as clearly with my left eye I require to bring that organ of vision as near to the figures as eight inches. On looking at my gold chain hanging on my breast in daylight, and with both eyes, the chain colored yellow, and toward the left, is perceived by the right eye, while a steely blue chain, another, yet the same, is perceived about an inch to the right and a little higher up. By artificial light the same phenomenon presents itself, but the difference of color is not so apparent; the yellow to the right is only dimmer. Again, when a page of *Nature* is being read with the short-sighted eye, there appears, about an inch to the left, part of the same column, small, and the black, under artificial light, like weak purple. The right hand side of this ghost-like column is lost to the right eye, being commingled with the larger, darker letters seen by the short-sighted left, which cover it like the more recent writing on a palimpsest. Middle life was reached before the discovery was made. These experiences must be gone through with intent, for objects generally being perceived altogether with the right eye, all that the left seems good for is to supply a little more light. The perception of the difference of color is as good with the one eye as the other, and the short-sighted eye can read smaller type. As the inferior animals, so far as I know, have no habit of peeping or looking with one eye shut and the other open, it occurred to me that this ability might be a limited one. I tried the experiment with school children, and to my surprise found that a few were quite unable to keep one eye shut and the other open at the same time, and a few did it with an effort, making in all about a fourth of the number. Adults were likewise under similar limits, but to a less extent. This may be the reason why the discovery of inequality of vision, as Sir John Herschel remarks, is often made late in life. Indeed, he mentions an elderly person who made the unpleasant discovery that he was altogether blind of an eye."

Something about White Lead.

My subject is white lead. I have been experimenting with it for some time, and am fully convinced that it should be used very sparingly in the painting of a carriage body, and more especially as a putty. You naturally ask why.

What is white lead? It is a corroded metal, which is capable of being brought back to its original state, but with a loss of its weight, thus proving that it has not lost its metallic property of expansion and contraction.

How can we prove this? Let us make a white lead putty taper 2 inches long, 1½ inch at the large end and 1 inch at the small end. Let it get perfectly dry, then have it turned accurately and fit a brass ring to the large end when the putty is at a temperature of 30°. Then raise it to 90° and attempt to pass it through the ring. You will find you cannot do it, thus proving that white lead putty expands at no uncommon change of temperature.

What are its adhesive qualities? Very little in itself. It is unlike glue or other resinous substance, which penetrates the fiber of the wood and in a manner clinches itself; but, like the brick to the mortar, is held by absorption.

How can we prove this? Paint a thin board with three coats of white lead mixed with oil and turpentine (or a brick is still better). When perfectly dry place it under an exhaust pump, and you will find that the white lead coats will part from the wood or brick.

Now, I need not tell you how we usually paint a carriage body, but do we not first coat it with lead and then freely coat it with a matter which has no expansive quality, except when subject to intense cold, and which contracts by heat? We here find that the element which expands the under coats contracts the outer ones. Is it any wonder that our paint cracks and peels off? Or that our putty protrudes and shows? Or can you tell me of a varnish that we can expect to be capable of resisting the laws of nature?

I have no suggestions to offer as to a substitute for white lead. I leave that for others—younger men than myself—and hope that some one will do so. N. J. F.

—*Varnish.*

A New Tin Alloy which Clings to Glass and Metals with Great Tenacity.

The American Journal of Photography recommends an alloy of 95 parts of tin and 5 parts of copper for connecting metals with glass for photographic and other purposes. The alloy is prepared by pouring the copper into the molten tin, stirring with a wooden mixer, and afterward remelting. It adheres strongly to clean glass surfaces, and has nearly the same rate of expansion as glass. By adding from one-half to one per cent of lead or zinc the alloy may be rendered softer or harder, or more or less easily fusible, as required. It may also be used for coating metals, imparting to them a silvery appearance.

BREAKAGE OF A THIRTY-FOOT FLYWHEEL AT THE AMOSKEAG MILLS, MANCHESTER, N. H.

Among the numerous engines of the Amoskeag Corporation, at Manchester, N. H., is a pair of 36-inch Corliss cylinders driving on to a single shaft carrying a flywheel 30 feet in diameter, 110 inches across the face, and weighing 64 tons. This wheel was belted to two jack shafts beneath the floor of the engine room, one at the cylinder end of the engine being driven by two 42-inch belts, and the other at the flywheel end driven by a 24-inch belt, running in the center of the pulley between the twin belts to the other shaft. The arrangement is shown by the diagram. This engine was used in times of high or low water, and on the 15th of October last was driving by the twin 42-inch belts mills Nos. 4 and 5, and by the 24-inch belt mills Nos. 7 and 8 and the dye house.

There was also connected to each jack shaft a water wheel, but the gate of the one on the east shaft was barely open and the other was running on four-tenths gate, not sufficient to run the machinery and line shafting in its immediate neighborhood.

Between nine and half-past on the morning of the above date, the speed in No. 5 mill ran down, as the superintendent and overseer of the carding testify, to only about one-quarter of the normal. The help, as is the custom under such circumstances, threw off the machines, and the speed started up again, but again slackened when the belts were put on. The superintendent went to the engine room and found the engine running as usual, and the engineer had noticed no trouble. Together they inspected the pulleys upon the jack shaft, and the superintendent says that the belts were slipping and the pulley hot. The engineer, remarking that he would see, turned to go upstairs, and the overseer started back to the mill through the shaft tunnel. He had hardly got away before the crash which resulted in the ruin depicted in the engraving occurred.

Meantime, the second-hand from the same mill had come to the engine room window on the same errand. He testifies that he looked into the engine room through the window, and saw nobody there. In a short time he heard a noise "which sounded like two heavy pieces of iron coming together. At the same time there was a sheet of fire like that from an emery-wheel from the top of the south belt shooting toward the west." He then saw the engineer coming from below, and he and his assistant ran to the throttles and began to shut the engine down. They had not left the throttles when the crash came, although the valves were found one closed tight and the other open but a fraction of a turn. The engineer was killed outright, his assistant badly injured, and the flying pieces cutting away the floor of the drawing-in room, precipitated the occupants into the pump room below, killing two girls.

The ruptured wheel was 30 feet in diameter, and ran at 61 or 62 revolutions per minute, giving a rim speed of 95·6 or 97·4 feet per second. This, although a very high rim speed, does not approach the limit at which a sound wheel may be run safe from breakage from centrifugal force. Prof. William Marks says: "The speed of rim of flywheels is in some cases pushed to about 80 feet per second, but is probably not often exceeded." We can count, however, more than twenty flywheels by the builder of the Amoskeag engines which are run at rim speeds exceeding 90 feet per second, and a 30-foot wheel by the same builder has been running at the Merchant's Mill, Fall River, Mass., for twenty-three years, whose present rim speed is 86·6 feet per second. The Amoskeag wheel was found to have spongy places in the fractured parts. Such flaws are inherent in all heavy castings, but after eight years of successful running it is hardly permissible to say that the factor of safety in this wheel was insufficient. Superintendent Manning justly says in his testimony: "These flaws were all impossible to discern without destroying the wheel. Sounding would not show them."

While the speed in the mills driven by the twin 42-inch belts had run down, that in Nos. 7 and 8 driven by the 24-inch belt became accelerated just before the accident. The testimony of the operatives agrees in estimating the highest speed that would have been attained by their looms at 180 picks per minute, while the normal speed was 144. This would have indicated a rotative speed for the engine flywheel of $\frac{180}{144}$ of 61 = 76¼ revolutions. From a personal inspection of the wreck and the evidence so far submitted, we fail to find anything which points to a more excessive speed than the above. The governor belt was found on, and what remained of the governor was perfectly free to act. The question comes, then, whether the wheel parted from centrifugal force at this speed or whether it was subjected to other strains which resulted in its rupture.

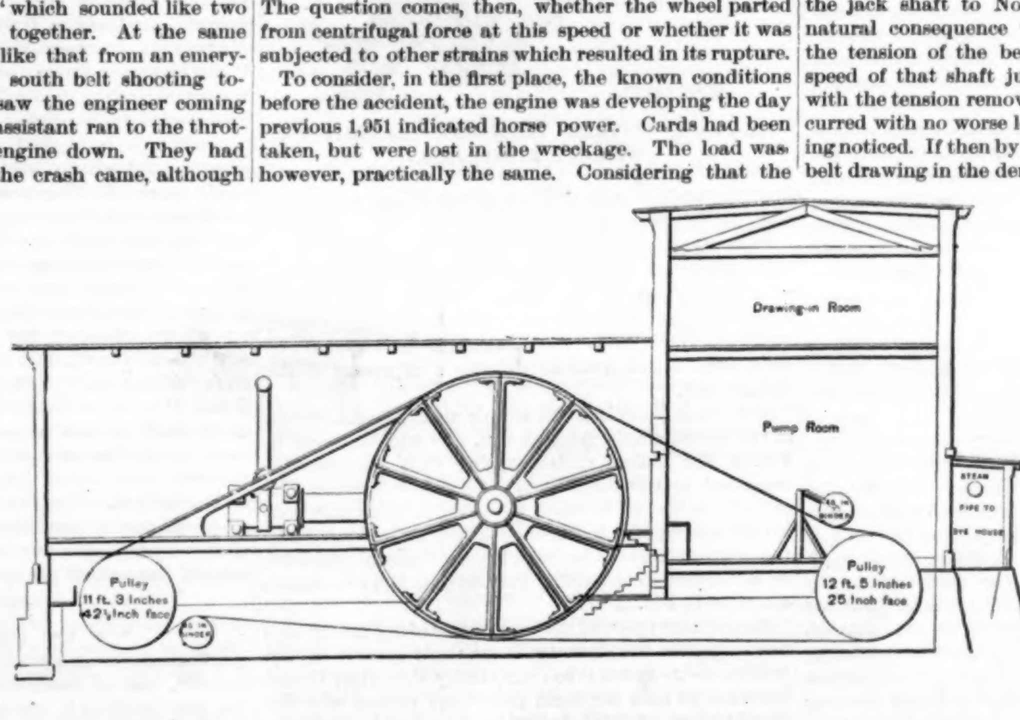
To consider, in the first place, the known conditions before the accident, the engine was developing the day previous 1,951 indicated horse power. Cards had been taken, but were lost in the wreckage. The load was however, practically the same. Considering that the brake horse power was 1,890, which allows a liberal percentage for engine friction, and that this load was evenly distributed upon the belts, we should have 42 + 42 + 24 = 108 inches of belt to carry 1,890 horse power, or $\frac{1890}{108}$ = 17·5 horse power per inch width of belt. This requires the transmission of 17·5 × 33,000 = 577,500 foot pounds of power per minute. The speed of the belts at 61 revolutions was 5,749·25 feet per minute, consequently the unbalanced strain per inch of width must have been 577,500 + 5,749·25, or over a hundred pounds. The normal strain for a double belt is about 70 pounds.

BURSTING OF FLYWHEEL—AMOSKEAG MILLS.

The proportion of the load transmitted by the twin belts to the shaft whose speed was slackened would, on the above assumption, be $\frac{84}{108}$ of 1,890 = 1,470 horse power, and it is readily apparent that belts under the degree of tension necessary to maintain anything like the above driving force could not have slipped for the length of time during which the speed was down in No. 5 mill and with the engine running at its normal rate without screeching and burning, so as to have attracted the attention of everybody about the engine house. The obvious conclusion is that the tension of the belts must have been relieved, and this naturally points to the binders beneath the jack pulleys on the east shaft.

Of the two binders, that to the south was the least damaged, though both were knocked out of position, and the north one almost completely demolished, the spokes being broken short off, and the rim, which was of wood, ground to splinters. The two idlers hung in separate journals from heavy cast iron beams, and these beams were knocked out of place and a considerable piece broken out of one of them. Of the large pulleys on the jack shaft, that nearest the end or the northern one of the pair was stripped to the hub, not a piece of a single spoke being left on. This was a split pulley, put in when the second cylinder was added to the engine. The other was made up of two narrow solid pulleys bolted together at the rims, and one half of one of the rims remained intact. The hubs of both pulleys are fast upon the shaft.

If now it had happened that the binders beneath the jack shaft to No. 5 mill became deranged, the natural consequence would have been a lessening of the tension of the belts and a running down of the speed of that shaft just as the evidence shows, and with the tension removed such slippage might have occurred with no worse local consequences than the heating noticed. If then by some means, as by the slackened belt drawing in the deranged idler or cramping its rim in some way, the jack shaft pulley was broken, its arms would be stripped by the belt as they were stripped, and the belt would have become entangled and given a monstrous wrench to the engine flywheel. The flywheel was 110 inches in width, with a single central set of arms, and the belt was on its outer edge. Such a yank might well be sufficient to produce a rupture in a rim constructed as this was. Many accessory facts point to the probability of such a sequence. The fact that one of the jack pulleys retained a portion of its circumference is evidence that it did not make a complete revolution after the general wreck had piled the *debris* about it, but that the other pulley upon the same shaft was completely stripped, shows that it must have made at least one complete revolution after it began to break. The general direction in which the pieces fell was to the northward, the direction in which such a pull would have started them. An engine whose governor is in normal condition will behave badly with a slipping belt, and



PLAN AND ELEVATION OF ENGINE ROOM OF AMOSKEAG MILLS, MANCHESTER, N. H.

the erratic action of the load with the twin belts acting as they must have done, further complicated by the water wheel, the wheel having the greater gate opening being attached to the shaft driven by the 24-inch belt, would account for the acceleration of the speed noticed in mills Nos. 7 and 8. Whether this acceleration was sufficient to have started a rupture in the rim of the engine wheel by centrifugal force, or whether the initial rupture occurred at the jack shaft, it is, however, impossible at this stage of the investigation positively to conclude.

The construction of the wheel itself will be evident from the remnants shown in the engravings. It had a single central set of 12 arms bolted into the hub in the manner shown, and to the ends of which the segments of the rim were bolted.

Of the twelve arms, two broke across the center line of the bolts in the hub, two were complete, three full length but broken at the outer end, and the rest broken across. The fragments of the rim were scattered from the river on one side to the mills across the yard at the other, and two pieces, one of which weighed 575 pounds, were thrown over upon the roof of No. 8 mill, which is at least 80 feet in height, with sufficient force to break through the heavy planking of which it is composed. The height to which a body would be projected vertically at the normal rim speed of the engine is over 140 feet. The only complete segment found was in the basement near the eastern jack shaft.—*Power.*

Rubber Foot Balls.

The game of foot ball is now of such widespread interest that much pains are taken with the ball for college use. It has an oval form, is made of the best rubber, with a pipe attachment for inflation, and is in turn incased in a stout cover, and laced. Such a ball is termed the "Rugby," and is made in one size, nine inches in diameter, and usually retails for about $4. As it is the *piece de resistance* in the contest, it is usually treasured with care when idle, although its usage is not by any means of a tender character on the field.

The ordinary foot ball comes in six sizes, respectively six, seven, eight, nine, ten and eleven inches in diameter, selling for $15 to $30 per dozen, so says *The India Rubber World.* This ball is carefully made of Para rubber and is nearly round, with a slight depression "at the poles," so to speak. The ball is made up in segments, usually six of them on the inside, there being a cloth surface, and cemented together. At the poles is a circular cap of the same material, on which the maker if so disposed can inscribe his name, or as in the case of the Hodgman Company, a handsome monogram. There is not a single stitch in these balls, and the workmanship is of such a character that when one of them is returned as defective, a black mark is made on the annual calendar of the general office of the factory. In all the years the number returned has been three in a product of thousands upon thousands of dozens.

The ball is inflated by means of a small hollow tube called a key, which fits into a cylindrical valve in the inside of the sphere. For transportation the deflated balls are packed closely in nests, taking but little room. A chief point is to get strength with light weight, great objection being made by teams to a heavy ball, which rolls sluggishly over the ground. The color of the undercase of the Rugby ball is white; the ordinary is black.

The great impetus given to the game bids fair to make this industry even more prominent than it has been in the past, and another season probably will see a much larger output than ever before.

Petroleum as Fuel in Lowell.

Accounts from Lowell state that the Tremont and Suffolk mills, Lowell, Mass., have made a practical success in using petroleum as fuel, and the estimate is made that a pound of the petroleum is equal to 1·8 pounds of coal. The mill uses the petroleum in the form of gas. The plant includes two tanks, which are buried in the ground about 30 feet from the furnaces, thus insuring safety from fire. A smaller tank is located above the larger ones and the contents of the latter are pumped into it. This small tank contains the supply for immediate consumption. A series of pipes run from here to the boilers, which are situated on a lower level.

The arrangement of the oil reservoir in relation to the boilers is perfectly safe. The level of the two large tanks is below that of the boilers, so in case the regulators fail to act and cause the tanks to burst, no serious results will follow, so far as fire is concerned. The upper tank is so small that its contents would soak into the ground before they reached the boilers, therefore no danger lurks here, even though the level of this tank is above the fires.

The oil flows from this reservoir through the pipes to the burners, under the boilers. These devices consume the oil in the form of spray mixed with steam. Perfect combustion is produced and no soot or smoke is caused, yet volumes of black smoke pour out of the chimneys surrounding the Tremont and Suffolk mills, while not the slightest trace of smoke can be seen issuing from its own. The fire is regulated by simply turning a valve. Thus it is under the immediate control of the firemen, and it is an easy matter to keep the steam at a uniform point. The mills used eight boilers before they introduced petroleum. To-day they are using but six, and yet the speed of the two powerful engines is the same and they have as much work to do as before. The neatness of the fireroom in consequence of there being no coal or ashes is an important point. The experiment has not been under way long enough to permit an estimation of the difference between the cost of oil and coal as fuel, but it is supposed that the difference is small. The oil is brought to the mills in tank cars containing from 3,500 to 6,000 gallons each.

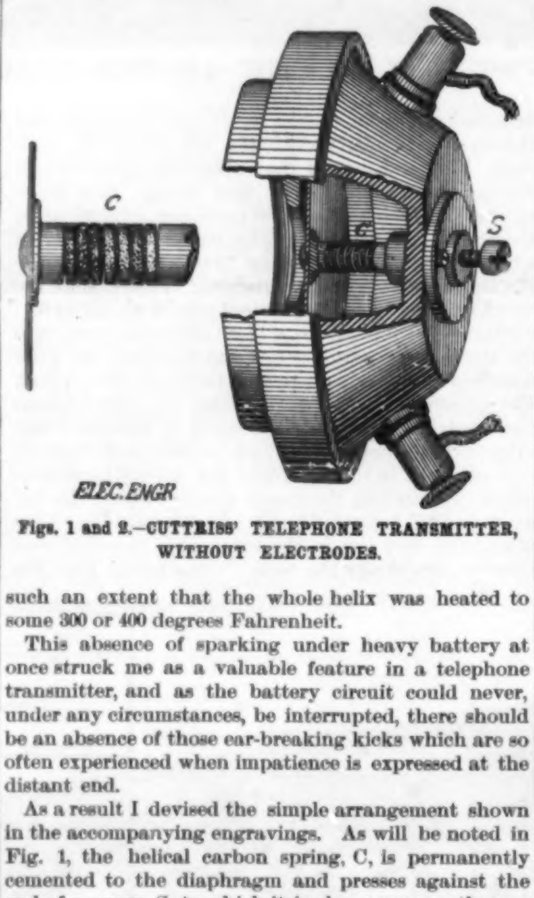
A TELEPHONE TRANSMITTER WITHOUT ELECTRODES.

BY CHAS. CUTTRISS.

While it would appear that the field of telephone transmitters had been pretty thoroughly gleaned, still among the stubble there has remained one that promises to be of considerable importance both for long and short distance transmission.

After trying numerous devices without success, it occurred to me that a helical carbon spring, if such a thing could be made, would offer the best solution.

After a few days' practice, little trouble was experienced in turning out about anything I desired. I now have the carbon helices of such resistances that when closed in their natural condition they have a resistance of about 10 ohms; but when fully distended the resistance is upward of 500 ohms, and a movement of 0·01 of an inch, tending to open the convolutions, makes a variation of from one to two hundred ohms. Their action on the instrument for which they were designed was perfect, and no sparking could be observed between the convolutions until the battery was increased to



Figs. 1 and 2.—CUTTRISS' TELEPHONE TRANSMITTER, WITHOUT ELECTRODES.

such an extent that the whole helix was heated to some 300 or 400 degrees Fahrenheit.

This absence of sparking under heavy battery at once struck me as a valuable feature in a telephone transmitter, and as the battery circuit could never, under any circumstances, be interrupted, there should be an absence of those ear-breaking kicks which are so often experienced when impatience is expressed at the distant end.

As a result I devised the simple arrangement shown in the accompanying engravings. As will be noted in Fig. 1, the helical carbon spring, C, is permanently cemented to the diaphragm and presses against the end of a screw, S, to which it is also permanently connected and by which its tension can be regulated and the convolutions of the helix brought nearer together, or separated, as desired. The carbon helix is shown enlarged in Fig. 2.

Experiments proved the correctness of my theory, and not only does the instrument transmit speech loudly, but the enunciation is so remarkably clear that I have been led to look for some particular reason why this should be so. I think it will be found to be owing to the extreme lightness of the helix (generally less than one grain); to the absolute continuity of the circuit—that is to say, the elimination of electrodes; and also to the fact as each part of the spiral is tending to open itself it absolutely precludes any tendency for the surfaces to jam or lock together.—*Electrical Engineer.*

IT is a well known fact that birds enjoy much longer terms of life than do mammals. Hesiod and Pliny both tell us of rooks that lived to the patriarchal age of 700 years, and that the average life of a raven was 240 years. How far this was correct we cannot determine. It is well known that they outlive man; while swans have been known to live 200 years, chaffinches and nightingales have been kept in confinement for 40 years. Girardin tells us that he had a heron for 52 years, and that he knew of two storks that built their nests in the same place for forty years.

Phonograph Improvements.

Mr. George H. Herrington, of Wichita, Kan., has recently patented a method of recording sound vibrations, in which the recording medium is first rendered plastic, then passed under the vibrating point or needle of the recording instrument while in such plastic condition, and finally allowed to harden, to set the impression and produce a permanent record.

He says: I employ as a recording medium to receive the needle indentations a material capable of being softened or made plastic and of afterward becoming hardened. I cause such surface to receive the indentations while in its softened or plastic condition, and it retains them when it becomes hard again. I prefer to employ a substance such as boiled tar, pitch, resin, asphalt, dental wax, or similar hard substances or compounds which become plastic when heated; and by the employment of heat I soften to the desired degree this surface as it passes under the point of the diaphragm needle, and then by cooling harden the surface to give the record permanency. The heat-affected medium is preferably applied as a coating to a suitable supporting thread, strip, or sheet of metal, fabric, paper, or rubber, and this supporting body is also preferably flexible, so as to be readily wound upon spools and passed around wheels or drums. The recording surface may also be covered with an extremely thin metallic foil or be powdered to prevent sticking to the needle or to the wheels or rollers while in a plastic condition. The heat may be applied in any suitable way, and air, water, or steam may be used, the recording medium passing through a heating chamber or over or around heating drums or rolls just before reaching the diaphragm needle. The cooling may be effected by an air or water chamber, or by drums, or by other suitable means.

The phonograph may have a motor to move the recording medium under the point of the diaphragm needle, and the same machine may, by the removal of the heating and cooling devices, be used to reproduce sound from such a record as has been described.

The same method and essentially the same apparatus can be employed for recording the movements of telephonic or telegraphic apparatus, so as to register messages sent by such instruments.

Insanity and Genius.

A good deal of comment has been excited by the publication in English of Professor Lombroso's work on "Insanity and Genius." It is a work in which the author claims that genius is the evidence of a degenerative taint, and is, in fact, an "epileptoid degenerative psychosis." We trust that our readers will not be made to feel a sense of apprehension concerning their own mental soundness by Professor Lombroso's thesis. It is one that has been worked at before by Moreau de Tours and a good many others, and neither the world in general nor the medical profession in particular has been seriously impressed by it. Men of genius have not, as a rule, been mad, except with an insanity of a scientific and scholastic kind, such as the world really needs more of. The eccentricities, monomanias, and emotional exaltations of genius have been incidental, and were not the basis of their character and temperament. Insanity is essentially a non-productive condition. No insane man has ever made a great discovery and originated great thoughts, or, by his own laborious efforts, changed the tide of human events. Insanity is a condition in which the power of adjusting one's self and one's conduct to the environment is lost. Surely there is no loss of this kind shown in the work or conduct of men of genius. Contemporaneous science has dealt somewhat kindly with Lombroso for the valuable work he has done and the new fields of study he has opened. But the *Medical Record* thinks that when he makes out Newton and Luther insane, and Christ a paranoiac, one must think that the professor himself has neither sanity nor genius.

New Use for the Telephone.

"The telephone is about to have a new application, namely, that of foretelling storms. A new discovery has been made as to one of the properties of this means of transmitting sound. By placing two iron bars at seven or eight meters distance from each other and then putting them in communication on one side by a copper wire covered with rubber and on the other side with a telephone, a storm can, it is said, be predicted at least twelve hours ahead through a dead sound heard in the receiver. According as the storm advances the sound resembles the beating of hailstones against the windows. Every flash of lightning, and of course every clap of thunder that accompanies a storm, produces a shock similar to that of a stone cast between the diaphragm and the instrument."

This paragraph, which we extract from a contemporary, is going the rounds of the papers as a fresh item of information. It is pleasing to note that the "discovery" was made as long ago as 1878, and that the SCIENTIFIC AMERICAN of that year and the following year contains several accounts of experiments in the same direction.

Correspondence.

Tin Poisoning.

To the Editor of the Scientific American:

A few weeks ago I read in your columns of the experiments in which Prof. Weber, of the Ohio State University, found such a number of "maximum doses" of tin in every sample of canned goods examined. Can you, or any of your readers, inform me what is the "maximum dose" of tin salts, with authority? In several authorities I have consulted, including Blyth on poisons, and Wood, I find no mention of tin at all. Although Battershall finds tin in 97 out of 109 samples, he seems not to consider it a serious matter, and Dietzsch makes no reference to tin in canned goods, etc. The contents of a thousand million cans or more are consumed every year, yet Jovian poisoning seems not yet to have become widespread. J. L. H.

Louisville, Ky.

How to Extinguish Oil Fires.

To the Editor of the Scientific American:

In an article from Edward Atkinson in your paper he recommends sand to extinguish oil fires. It is good, if nothing better is at hand; but sand is too heavy and settles to the bottom too quick. Common wheat bran or any kind of mill feed is far better, as it is a better absorbent and lighter and spreads easier. Oil burning in a vessel or on the surface of water cannot be extinguished by sand, as it sinks too quickly; but if a handful of bran be thrown on, it will smother out the flame before it gets saturated and sinks.

In manufacturing places, where the floor is saturated with oil, there should be kept handy a barrel or more of bran. Even wood ashes or road dust is better than sand. I have had twenty years' experience with carbon oils, and I know what is best with me. B.

Titusville, Pa., Dec., 1891.

Rain Making on a Small Scale.

To the Editor of the Scientific American:

I have read with interest the articles on "rain making" in your columns. They have served to recall a phenomenon I witnessed some years ago that may be of general interest.

On a warm, close, foggy June morning after an early shower I was fishing from a boat on a small mill pond, about 100 yards from a house that stood on its edge. While watching the float on my line, some one closed the outside door of the house with a bang, producing a decided concussion on the air. As if a tree loaded with moisture had received a shock, so the rain drops fell on the smooth water all around at the same instant I heard the sound. So closely was the sound accompanied by the precipitation that it became evident to me at once that the concussion caused that short rainfall. G. R. OVERHOKER.

Reamstown, Pa.

Florida Vegetation—Naphtha vs. Storage Battery Launches.

To the Editor of the Scientific American:

I noticed in your valued paper an engraving taken from a photograph of the banyan or rubber tree here on Lake Worth, and from the comments thereon I was led to believe that a mistaken idea prevailed among most northern people of the peculiar plant life which is met with here.

The fact of the proximity of the warm Gulf Stream makes the immediate coast climate remarkably uniform. Extremes of heat or cold are unknown, and a tropical luxuriance abounds on the hammock lands almost beyond belief to those who have only been familiar with northern Florida.

Cocoanuts or mangoes will not withstand frost, yet there are thousands of bearing cocoanut trees here now, and enough bearing mangoes to demonstrate the practicability of its extened culture, and extensive plantations are being planted.

Yet, strange as it may seem, the yellow pine, used so extensively now for lumber, does not seem to do so well here as in northern Florida or Georgia. Perhaps it is owing to the soil.

Have watched with interest the discussions of correspondents on jet propulsion. While I have nothing to offer in that line, I would like to inquire through your columns if electrically propelled boats can be run economically when near a station where batteries can be charged cheaply. Or will weight of batteries and expense of maintenance exceed that of steam or naphtha fitted boats or launches?

What can some one who is familiar with the subject tell about it? W. H. SANDERS.

Lake Worth, Dade Co., Fla.

MR. GEORGE L. SEVEY, an ingenious marble cutter of West Somerville, Mass., has made a small operating engine composed of marble. It has a vertical piston and two side flywheels. The height is 23 inches and it is 10 by 20 inches square. There are one hundred pieces of marble, held together by 12 brass screws. The engine is operated by air pressure.

Teaching the Deaf to Speak.

The Volta Bureau of Washington has prepared a souvenir of the first summer meeting of the American Association to Promote the Teaching of Speech to the Deaf. The book deals wholly with the case of Helen Adams Keller, the wonderful child who at the age of eleven years has learned to speak and to write, although she is blind and deaf.

This child's progress was the subject of an essay at the last meeting of the association by Sarah Fuller, principal of the Horace Mann School for the Deaf, of Boston. The child was possessed of all the faculties and senses of a healthy child, so far as was known, until upon recovery from a serious illness at the age of eighteen months she was found to have lost her hearing and sight. In 1887 she was placed under the instruction of Miss A. M. Sullivan, who had been educated at the Perkins Institution for the Blind, in Boston. Under this instruction Helen developed with astonishing rapidity the genius which has since commanded the admiration of those interested in instructing the deaf.

In 1888 Helen paid a visit to the Horace Mann School. The interest that she then manifested in the children and in the course of instruction suggested to Miss Fuller that she could be taught to speak. It was nearly two years later, however, before any effort was made in this direction. Learning at that time that a deaf and blind child had acquired speech, Helen became anxious to learn to speak, and Miss Fuller was quite ready to undertake to teach her.

Miss Fuller's essay describes how she gave the child her first lesson. It was evidently a task requiring much patience, for Helen was obliged to learn how to use her organs of speech by feeling her teacher's mouth and throat, and determining by the same means the position of the tongue and teeth. She proved an apt pupil, and in a little while she was able to pronounce the vowels and to give utterance also to some of the consonants.

Having gone through this preliminary drill, the teacher shaped her lips for the vowel "a," and, with the child's fingers as guides, she slowly closed her lips and pronounced the word "arm." Without hesitation, Miss Fuller says, the child arranged her tongue, repeated the sound, and was delighted to know that she had pronounced a word.

Her next attempt at pronunciation was with the words "mamma" and "papa," which she had tried to speak before going to the teacher. The best she could do with these words was "mum-mum" and "pup-pup." The teacher commended her efforts, and in order to illustrate to her how the words should be correctly pronounced she drew her finger along the back of the child's hand to show the relative length of the two syllables, the child's other hand in the meanwhile resting on the teacher's lips. After a few repetitions the words "mamma" and "papa" came with almost musical sweetness from her lips.

There were nine lessons after this in which the child proved an ideal pupil, following every direction with the utmost care, and seeming never to forget anything told her. At the close of her lessons she used speech fluently. She received her first lesson March 26, 1890, and April 19 of the same year, while at the house of a friend, she related an account of a visit she had made to Dr. Oliver Wendell Holmes, in which her pronunciation was so good that there were only four words out of more than a hundred that the teacher failed to understand.

As part of this souvenir there are two letters wonderfully well written by the child, the first at South Boston, April 3, 1890, and the second at her home at Tuscumbia, Ala., October 20, 1890. A photograph of the child is also published in the souvenir.

Helen Adams Keller is the daughter of Major Arthur Henry and Kate Adams Keller. She was born at Tuscumbia, June 27, 1880.

Cement Testing.

In a paper on cement testing recently read before the Engineers' Club of St. Louis, it is stated that probably the cement testing laboratory at Berlin is that which enjoys the greatest confidence both of consumer and producer. In this laboratory it is usual to observe (1) the weight per liter, (2) the quantity of water required to produce plasticity, which varies with the density of the clinker, with the time of setting of the cement, and with its fineness, (3) the rise of temperature during setting, which varies with the amount of lime in the cement and with its fineness, but is also affected by the temperature, as cement does not set below freezing point, and (4) the fineness of the cement, which is of great importance, and finally the tensile strength both neat and made into cement mortar. If ordinary cement is sifted through a sieve having 30,000 to 40,000 meshes to the square inch, the residue remaining on the sieve is found to have little or no tensile strength. But if this residue is taken and reground, a cement will be produced superior to the original cement, as the comparatively large particles which remained on the sieve were the best clinker, which is most difficult to pulverize. These facts show that ordinary commercial cement consists of cement and inert material, and very finely ground cement is weaker than common cement when tested neat, but stronger when made into mortar. The dividing line between true cement and inert material is not exactly known, but a sieve having about 35,000 meshes to the square inch is probably very near it. The first test of cement, therefore, should be for the percentage that will pass through such a sieve, which quantity will be the true cementitious material. On testing an English and a German cement, the author of the paper found that 10 per cent of the English cement and only 1½ per cent of the German cement were left on a sieve of 10,000 meshes to the inch, but on proceeding to use a sieve with 32,000 meshes to the square inch about the same percentage of both cements came through, and both therefore contained about the same quantity of cementing material. Hence a sieve of 10,000 meshes to the square inch is too coarse to properly gauge a cement.

Lasioderma Serricorne.

We submitted a correspondent's letter relating to the tobacco insect to Dr. C. V. Riley, of the entomological division, Washington, who replies as follows:

The sample of chewing tobacco which you sent a few days ago, with letter of inquiry regarding nature of injury and possible remedies, has been received. The injury is due to the beetle known to naturalists as *Lasioderma serricorne*. It is well known from the damage it does to dried tobacco of all forms. I inclose an account of this insect, together with the remedies that may be employed against it, from the pages of *Insect Life*:

"The insect is a species which is found all over the world, feeding in Cayenne pepper, spices, tobacco, and other pungent substances. It is *Lasioderma serricorne*. This injury to cigarettes has been observed in other localities, and samples of damaged goods have been sent to the division before. In tobacco warehouses in Baltimore particularly it has done much injury to cigars and cigarettes, preferring the latter. It is very abundant one year and then disappears almost entirely for a number of years. It is a night flier, and enters storehouses through open windows or cracks at night only. The best way to destroy the larvæ and eggs is to thoroughly steam all the tobacco. The steaming which is done in the preparation of cigarette tobacco is either not thorough enough or the tobacco is left for a longer or shorter time after steaming and before being made up, and in this interim the beetles enter it. Many precautions should be used. Cut tobacco should be kept in tightly-closed boxes when not in use. All manufactured cigarettes should be packed up at the close of the day's work, or if this be not possible, they should be closely covered with flannel cloth. All the windows in the building should be closed at night, and its general cleanliness should be carefully looked after. No dust heaps should be allowed to accumulate, and the walls should be kept whitewashed. The bisulphide of carbon would hardly be a safe or pleasant remedy in this case. It would be of considerable interest if you would carefully rear the insect and note its habits and natural history, particularly the length of time of the different larval stages and the number of annual generations."

To Keep Iron Pipes from Rusting.

A simple and economical way of tarring sheet iron pipes, to keep them from rusting, is as follows: The sections as made should be coated with a coal tar and then filled with light wood shavings, and the latter set on fire. It is declared that the effect of this treatment will be to render the iron practically proof against rust for an indefinite period, rendering future painting unnecessary. In proof of this assertion, the writer cites the example of a chimney of sheet iron erected in 1866, and which, through being treated as he describes, is as bright and sound to-day as when erected, though it has never had a brushful of paint applied to it since. It is suggested that by strongly heating the iron after the tar is laid on the outside, the latter is literally burned into the metal, closing the pores and rendering it rust proof in a far more complete manner than if the tar itself was first made hot and applied to cold iron, according to the usual practice. It is important, of course, that the iron should not be made too hot, or kept too hot for too long a time, lest the tar should be burned off. Hence the direction for the use of light shavings instead of any other means of heating.

Our Winters will Gradually Grow Milder.

A reverse of seasons is supposed to take place upon this earth once in every 10,500 years, due to the varying inclination of the earth's axis. About 1,500 years ago we entered the epoch of a more genial winter temperature, and if nothing happens to prevent, we may expect a gradual softening of our winter climate during the next nine thousand years, when another glacial epoch will begin. What sort of a country will this be in the year 11,500? Will it resemble Egypt, with remains of great buildings buried or sticking up out of the sand, and known to be more than 4,000 years old?

THE FIRST VOYAGE OF COLUMBUS.

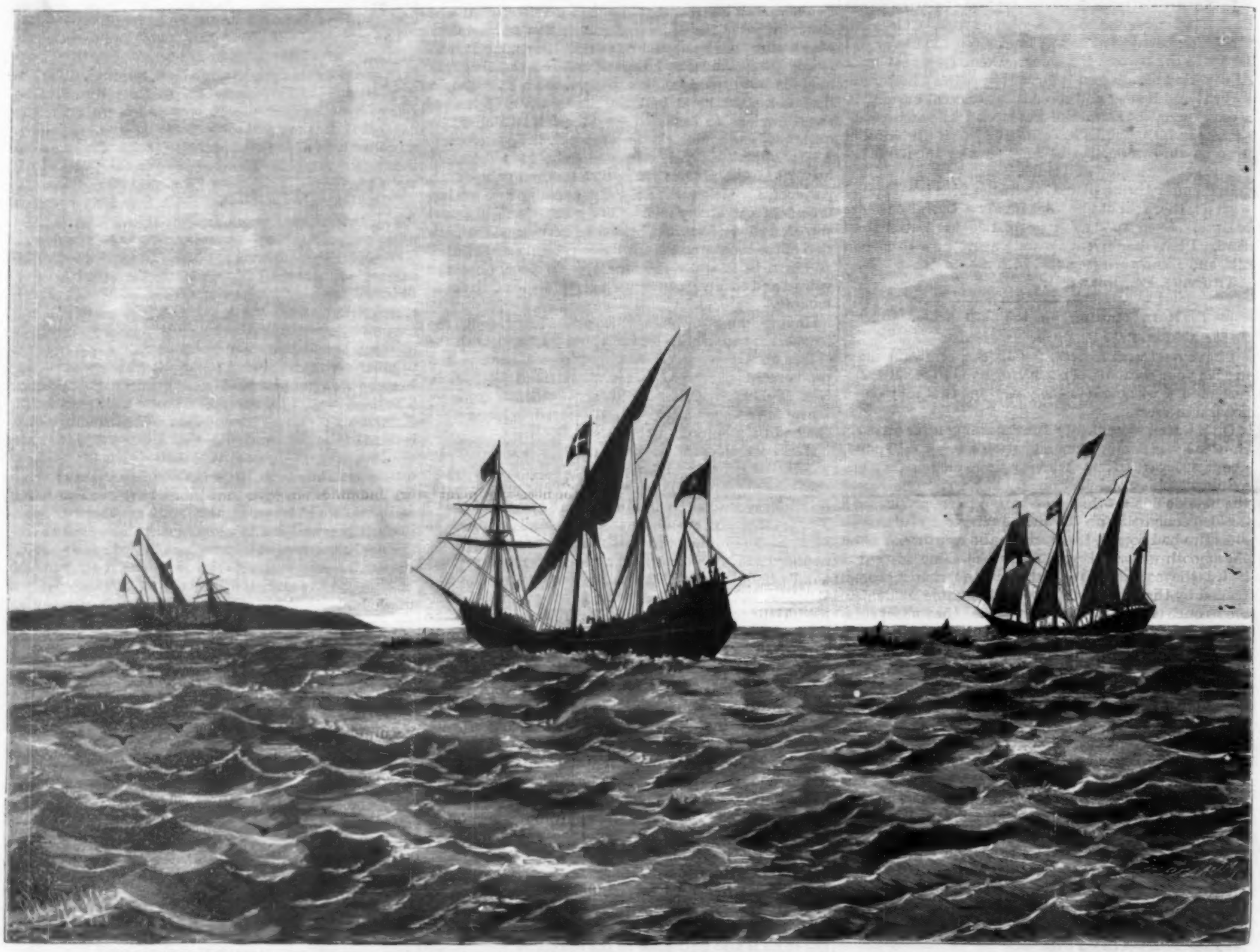
There will probably be no more interesting exhibition in connection with the World's Fair than the facsimile which it is proposed to construct of the Santa Maria, the vessel in which Columbus himself sailed on his voyage of discovery. It is designed that this vessel shall be rigged as was the original, and manned by Spanish sailors in fifteenth century costumes, having on board also representatives in costume of all the functionaries who accompanied Columbus. It is hoped that this vessel will be ready in time to have a place in the naval review in New York harbor in October of this year, after which it is to be transferred with due pomp and ceremony to Chicago, where it will afford not the least of the many wonderful exhibits there presented.

As is well known, there were three vessels in the fleet commanded by Columbus, and the appearance they presented on approaching the first land of the New World is the subject of the accompanying illustration. Our engraving is from the celebrated picture by Antonio Brugada, now in the Naval Museum, Madrid. It represents the three vessels of Columbus' fleet when they sighted the island of San Salvador on the morning of Friday, October 12, 1492, the large central one being the Santa Maria, in which Columbus sailed, the other smaller vessels being the Pinta at the left and the Nina at the right.

The Santa Maria was of 90 feet keel, and had four masts, of which two were square rigged and two fitted with lateen sails. It was decked from stem to stern, having also a poop 26 feet in length, "beneath which was the armament of heavy guns, with small pieces forward for throwing stones and grape." It had eight anchors and carried 50 seamen. The other vessels were styled caravels, undecked, and of small size, which was deemed an advantage for exploring rivers and coasts, the Pinta having a crew of 30, and the Nina of 24 men. There were a surgeon, a physician, and some others, making a total of 120 souls in the whole expedition.

The voyage which terminated in the great discovery on the 12th of October, 1492, was commenced from the little maritime town of Palos, in Andalusia, on the morning of the 3d of August preceding. Three days afterward the Pinta lost her rudder and they put in at Teneriffe to repair, sailing thence September 6. On September 13 the variations of the magnetic needle were first observed, and on September 16 they entered the vast plains of seaweed since called the Sargasso Sea. On the 18th and 20th many birds were seen, but the land they were thought to indicate did not appear and the men became greatly afraid and discontented. On the 25th a false cry of land was raised, and also on October 7, and on the 11th the Pinta fished up a cane, a log of wood, a stick wrought with iron, and a board. At 10 o'clock on that night Columbus is said to have pointed out a light ahead, and at 2 o'clock on the morning of Friday, October 12, Rodrigo de Triana, a sailor aboard the Nina, announced the appearance of what proved to be the New World. The same morning Columbus landed, in rich robes, bearing the royal banner of Spain, and took solemn possession of the newly discovered territory for their Catholic Majesties of Castile and Leon.

Several other islands of the West Indies were discovered by Columbus on this first voyage, including the islands of Cuba and Hayti, or San Domingo, and off the coast of the latter island the Santa Maria went aground. No lives were lost, but the vessel was unloaded and had to be abandoned, so that Columbus, in returning to Europe, had to set sail in the little open Nina. The return voyage lasted from the 16th of January to the 4th of March, 1493, on which latter date the Nina dropped anchor off Lisbon, and Columbus was thence for a period the most highly honored and distinguished of all the grandees in attendance upon the Spanish court. He made two more voyages to the New World he had discovered, and died thirteen years afterward at Valladolid, in comparative obscurity and neglect.



DISCOVERY OF THE NEW WORLD BY COLUMBUS—THE ARRIVAL AT SAN SALVADOR, OCTOBER 12, 1492.

From the painting of Brugada, in the Naval Museum, Madrid.

Large Auxiliary Ship.

One of the most interesting vessels now in course of construction on the Clyde is the five masted sailing ship on the stocks of those noted builders of sailing craft, Messrs. Russell & Co., Port Glasgow, to the order of Messrs. Rickmer, of Bremen. She is five masted, will measure about 3,800 tons register, and will carry at least 6,000 tons dead weight. But apart from her great size and the fact that she is built on the cellular system for the accommodation of water ballast, her most distinctive claim to the attention of the shipping world lies in the fact that she will be supplied with triple-expansion engines of sufficient power to propel her when loaded at the estimated rate of from seven to eight knots per hour in calm weather, the medium of propulsion being a "Bevis" patent feathering gun metal screw, which has been fitted in many government vessels and large first-class auxiliary yachts with highly successful results. The career of this semi-sailing, semi-steam vessel will be followed with interest by all concerned in shipping.

A Gas Well Reopened.

A strange thing happened the Royal gas well near Venice, Pa., on the Barrett farm. The gas was struck some time ago in the fifth sand, and it poured out in a steady stream until a few days since, when it stopped. It was discovered that the well had caved in, and it was supposed it was full of rubbish to the bottom. The men were ordered recently to drill it over again. They had not been at work long when there was a terrific explosion and the tools were blown out of sight, leaving the well as clean as a whistle. It seems that the cave-in had formed a bridge, and when it was pierced, the pressure of the accumulated gas did the rest. The well is now supplying as much gas as ever. This is the first time in the history of the business that such an event has occurred. The chances are that any number of wells that have ceased flowing are clogged up with debris.

Collision between a Steamship and a Whale.

The Anchor Line steamer Ethiopia, on its last passage to New York, encountered a large whale about 800 miles east of Sandy Hook. The captain and second officer were on the bridge, keeping a close watch ahead. Suddenly a whale came to the surface directly in the path of the ship, and only a few feet ahead. The ship was rushing toward the whale at the rate of 16 miles an hour. There was no time to check the speed of the vessel, and almost before the astonished officers realized it the ship's sharp iron prow crashed into the monster. The blow was a direct, incisive one. The ship seemed to sail right through the whale, which disappeared almost immediately, leaving a trail of crimson as far as the eye could see. Shortly afterward the whale was sighted astern, floating lifelessly. When the ship came into collision with the whale, the shock caused the vessel to tremble from stem to stern, and somewhat startled the passengers.

PROGRESS OF THE WORLD'S FAIR BUILDINGS.

The site of the Columbian Exhibition at Chicago has been for some time a scene of the most stirring life and energy, and the grounds are rapidly taking on the appearance the architects and managers have designed they shall present before the opening of the great fair. The rate of progress being made cannot be fully appreciated on the mere understanding that some four thousand men are now regularly at work on the fair grounds, for, with the generous scale on which the expenditures are being made, and the careful elaboration of the plans before the work was commenced, it is apparent that another and a greater army of co-laborers is at work getting ready and forwarding to the site the materials to be used, such materials being furnished, as far as possible, in a state which calls for comparatively little work to fix in completed condition.

Our first page illustrations represent the present appearance of three of the important buildings of the fair which are now nearing completion, the work on these structures being further advanced than that on any of the others, although a great deal has been done on each of the main buildings. The Woman's Building is entirely inclosed and the oilers and painters are putting on the outside finish, while the plastering and completion of the inside is in progress. The roofing of the Mines Building is being rapidly completed, and that of the Transportation Building, although not quite so far advanced, is being energetically pushed forward. The mild weather through most of December afforded opportunities for pressing the outside work which had hardly been looked for, but which were taken advantage of to the fullest extent. This circumstance also permitted of almost continuous operations being carried on in the docking of the interior waterways, and the landscape gardener, Mr. Ulrich, has been able to keep about four hundred men employed in grading, filling, and tree planting.

At the same time the work in all the other departments is actively progressing under the direction of numerous mechanical, electrical, sanitary, railroad, and municipal engineers. The engines, boilers, and belting to form the power plant will be obtained mostly free of cost from exhibitors, by whom they will be installed as exhibits, and it is said that in this way the necessary plant for 16,000 horse power, of the 25,000 to be provided, is already secured. Negotiations have also been closed with Henry S. Worthington for a pumping plant free of cost for service on the grounds, with a capacity of 40,000,000 gallons per day. A triple expansion engine to be furnished by a Milwaukee firm has cylinders 30, 58, and 88 inches in diameter, with a 60 inch stroke. Another firm is to furnish six large engines developing an aggregate of 3,000 horse power, operating also compound air compressors, the feed pumps, heaters, condensers, and other appliances needed for the entire plant having been secured without cost as exhibits. So many of the belting manufacturers have offered to run belting as exhibits that it is not doubted all the supplies desired in this line will be obtained free of cost. A temporary power plant of 700 horse power is now in operation on the grounds, and a temporary pumping plant having a capacity of 3,000,000 gallons per day.

About nine miles of sewer pipe have been already laid on the grounds, half of the entire work of pipe-laying being finished. Eighty hydrants for the permanent work have been set, and forty-eight ejectors are being made for discharging the sewerage of the principal buildings. Ample provision has been made to protect the buildings in progress from fire, and the laying of the permanent water pipes is well advanced.

The electrical engineer has completed the plans for the interior lighting of all the buildings. These plans are said to call for 7,000 arc lights of 2,000 candle power each and 130,000 incandescent lights of 16 candle power each. The plant for this lighting is to be put in position and operated by contractors during the time of the exhibition, and it is estimated that the amount of electric lighting will be ten times as much as was employed at the Paris Exposition. A temporary plant for electric lighting and power now supplies all the saw mills and hoisting machinery on the grounds.

The Woman's Building, now so nearly completed, was happily designed by a woman, Miss Sophia G. Hayden, of Boston, who received a prize of $1,000 for the best design furnished. It is 200 by 400 feet in size, and has corner and center pavilions connected in the first story by an open arcade, surmounted by classic vases. The first story is Doric and the second Ionic, the center pavilion containing the main entrance, and being treated as a triple open archway of the story above, with a row of free-standing Corinthian columns. The main gallery of the building will be 60 by 240 ft., and there will be one room 80 by 200 ft. in which will be shown matters connected with woman's work from the earliest ages of history to the present time.

The Transportation Building, between the Horticultural and Mines Buildings, is very refined and simple architecturally. The main building is 960 ft. front and 256 ft. deep, and it will have a triangular annex of one story buildings covering nine acres. Its cupola will be reached by eight elevators, and from it a most beautiful view will be obtained of the entire exhibition. Its main entrance will be a magnificent single arch, enriched to an extraordinary degree with carvings, reliefs, and paintings. The display here of locomotives, cars, and everything belonging to the department of transportation will, without doubt, far surpass anything ever before planned anywhere.

The Mines and Mining Building is 700 by 350 ft. in size, and the height to the main cornice is 65 ft. The grand entrances are at the north and south ends, and are 110 ft. high and 32 ft. wide, each opening into a vestibule 88 ft. high and elaborately decorated. At each corner of the building is a pavilion 68 ft. square and 90 ft. high, surmounted by a dome. The roof is of glass, 100 ft. from the floor, and a balcony 60 ft. wide and 25 ft. high encircles the building, eight stairways leading to this balcony.

The appearance of the staff ornamentation, as well as the manner in which it is produced, is well brought out in our illustration of the clay model for a portion of the arch of one of the doors in the Mines Building. The section shown embraces five or six different pieces, all so nicely joined on board backing that it is impossible to tell where the pieces come together, and yet readily separable to make the gelatine moulds therefrom, in which the staff is cast in sections of convenient size to be easily handled. These gelatine moulds are about an inch thick in substance, and bring out all the fine lines of the model with great distinctness, the staff castings in them accurately representing all the details of the most delicate designs. The staff is a composition of plaster of Paris and tow or other fiber, with a varying amount of alumina, glycerine, dextrine, etc., according to the special casting to be made. Almost any color desired may be readily produced upon it by simple external washes. There are now three considerable establishments on the fair grounds, employing altogether about 400 hands in the manufacture of this style of exterior ornamentation for the Exposition Buildings.


CLAY MODEL FOR SECTION OF ARCH OF DOOR IN MINES BUILDING.

PROF. DR. KOBERT has proved experimentally that hydrogen peroxide is a valuable antidote for hydrocyanic acid poisoning. It is to be given internally as well as subcutaneously until the odor of the acid can no longer be recognized in the exhalations and the symptoms subside. He found that lethal or even larger doses could be given to animals daily for several weeks, if hydrogen peroxide be injected in one cubic centimeter doses when the symptoms of poisoning appear. The antidote acts by changing hydrocyanic acid into oxamide.—*Pharm. Centralhalle*, 1891, 570.

Cotton Oil Soap.

In the Queen's Bench Division Mr. Justice Charles lately gave judgment in the case of Wilson v. Union Oil Mills Company and Pearson. The action was brought by Mr. John Hazelgrave Wilson, chemist and patentee of process for bleaching soap, against the Union Oil Mills Company, of South Sea House, Threadneedle Street, London, and Mr. Isaac Pearson, chairman of the company, and an oil refiner, carrying on business at the Rock Villa Oil Mills, Glasgow.

The plaintiff claimed a royalty of 2*l*. per ton on all soap manufactured by his process, or, alternatively, damages for alleged infringement of his patent, and an injunction to restrain the defendants' further infringing.

The defendants denied having agreed to pay a royalty, or having committed any infringement of the plaintiff's patent, and alleged that the patent was invalid.

The plaintiff's patent was taken in 1883, and aimed to utilize, for the purpose of manufacturing a good commercial soap, the mucilage, or "cotton oil foots," which was a waste product in the preparation of refined cotton seed oil. The oil, when first expressed from the cotton seed, is of a dark port wine color, and contains suspended in it particles of the husk of the seed which had passed into it during the extraction of the oil by hydraulic pressure. The dark oil is treated with a solution of caustic soda, which partly saponifies the oil, and carries to the bottom of the vessel in which the oil is placed the coloring matter and the portions of the husk remaining in the liquid, leaving the oil of the color of an intermediate sherry. The mucilage or matter which falls to the bottom of the oil consists of partially saponified matter mixed with portions of free oil, caustic soda, and the resinous and albuminous compounds obtained from the husk of the cotton seed. Some thousands of tons of this mucilage are produced from the various factories every year, and the plaintiff claimed that his process not only produced a good commercial soap, which it was not difficult to do, but yielded this in a bleached condition, so that it could be used for washing materials without staining them. The bleaching was accomplished by means of hypochlorite of sodium, and he alleged that the defendants had adopted the main features of his patent.

The defendant Pearson and Mr. Tatlock, the public analyst of the city of Glasgow, proved that the process as described by the plaintiff in his specification was unworkable, and that it was impossible to separate the coloring matter from the soap by the use of hypochlorite of soda in the manner directed by the plaintiff by reason that the resinous and albuminous coloring matter absorbed any amount of the bleaching agent employed without any appreciable alteration in the color, and that the common salt produced by the decomposition of the hypochlorite of soda under the action of heat was detrimental to the process, as it threw up the coloring matter in a fine state of division and mixed it with the soap, so that the soap produced was useless. The witnesses further proved that in the process used by the defendant Pearson, which he had patented, and which was the result of a large number of experiments after the failure of the plaintiff's process, the defendant saponified the mucilage with an excess of very strong caustic soda, which not only produced soap but also dissolved out the coloring matter. The defendant then passed open steam into the boiling mass and produced a violent mechanical agitation of the liquid, and a complete separation of the soap from the colored solution took place, and the soap could be at once run or skimmed off, and after the soap had been washed with dilute alkali a good marketable soap was produced, which caused no discoloration in any fabric washed with it. The soap was somewhat dark in color, and as at first there was some prejudice in the trade, the defendant bleached the soap by boiling it with hypochlorite of soda, and this was the infringement complained of. The defendant had not, however, bleached more than about 400 tons of the soap, and was now producing a soap about the color of Pears' soap without the use of any bleaching agents.

A large body of evidence was called to prove the failure of the plaintiff's process, and several soap makers gave evidence of the use by them of hypochlorite of sodium for bleaching soap long prior to the date of the plaintiff's patent, and various specifications of Longmore, Watt, Briqueler, and others were put forward as anticipating the plaintiff's patent.

Judgment was given in favor of the defendant.

Purifying Carbon Bisulphide without Distillation.

One liter of the carbon bisulphide is treated with 0·5 c. c. of bromine and allowed to stand for three to four hours. The excess of bromine is removed by agitation with caustic potash or copper turnings. Any remaining cloudiness may then be removed by agitation with a little dry calcium chloride, with subsequent filtration. The carbon bisulphide treated in this way is colorless, of pleasant smell, and evaporates without residue.—*A. Chenevier.*

Luminous Paints.

FOR ORANGE LUMINOUS PAINT, 46 parts varnish are mixed with 17·5 parts prepared barium sulphate, 1 part prepared India yellow, 1·5 parts prepared madder lake, and 38 parts luminous calcium sulphide.

FOR YELLOW LUMINOUS PAINT, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide.

FOR GREEN LUMINOUS PAINT, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts chromium oxide green, and 34 parts luminous calcium sulphide.

A BLUE LUMINOUS PAINT is prepared from 42 parts varnish, 10·2 parts prepared barium sulphate, 6·4 parts ultramarine blue, 5·4 parts cobalt blue, and 46 parts luminous calcium sulphide.

A VIOLET LUMINOUS PAINT is made from 42 parts varnish, 10·2 parts prepared barium sulphate, 2·8 parts ultramarine violet, 9 parts cobalt arsenate, and 36 parts luminous calcium sulphide.

FOR GRAY LUMINOUS PAINT, 45 parts of the varnish are mixed with 6 parts prepared barium sulphate, 6 parts prepared calcium carbonate, 6·5 part ultramarine blue, 6·5 parts gray zinc sulphide.

A YELLOWISH-BROWN LUMINOUS PAINT is obtained from 48 parts varnish, 10 parts precipitated barium sulphate, 8 parts auripigment, and 34 parts luminous calcium sulphide.

LUMINOUS COLORS FOR ARTISTS' use are prepared by using pure East India poppy oil in the same quantity instead of the varnish, and taking particular pains to grind the materials as fine as possible.

FOR LUMINOUS OIL COLOR PAINTS, equal quantities of pure linseed are used in the place of the varnish. The linseed oil must be cold-pressed and thickened by heat.

All the above luminous paints can be used in the manufacture of colored papers, etc., if the varnish is altogether omitted, and the dry mixtures are ground to a paste with water.

The luminous paints can also be used as WAX COLORS FOR PAINTING ON GLASS and similar objects, by adding, instead of the varnish, 10 per cent more of Japanese wax and one-fourth the quantity of the latter of olive oil. The wax colors prepared in this way may also be used for painting upon porcelain, and are then carefully burned without access of air. Paintings of this kind can also be treated with water glass. —*Ztschr. Oest. Ap. Ver.*

Magnetism.

In tools it is due to a combination of position and vibration.

It is well known that vibration greatly assists change in the magnetic state of a piece of iron placed in a magnetic field, and Ewing has shown this quantitatively by a series of curves derived from actual experiment.

The phenomenon of hysteresis, or the lagging of a magnetic effect behind its cause, which is existent in all qualities of iron and steel, in soft annealed iron least and in hardened steel the most, is almost entirely obliterated in the former, and greatly lessened in the latter, when the bar is subjected to vibration.

A simple experiment, within the reach of nearly every one, to show this effect, is the following:

If an ordinary wrought iron poker be held in a vertical north and south plane and one end be dealt a sharp blow, it will be found to have assumed polarity, which may be proved by presenting the ends in turn to the north-seeking end of a compass. One end of the poker will attract and the other repel. If now the poker be reversed in position and the other end tapped, the polarity will be changed, and the end which formerly attracted the north end of the needle will now be found to repel it.

The maximum effect is produced when the bar is held parallel with the dipping needle, and it gradually disappears as this angle is departed from, until, when held at right angles to the dipping needle, no polarity is developed by the blow, and if the bar already have polarity, it may be completely removed by striking the bar when in this latter position.

Since a dipping needle may not be accessible, this latter effect may be easily produced by striking the bar when held horizontally in an east and west position. It will then be at right angles to any vertical angle in a north and south plane. As before stated, the bar will acquire no polarity if struck when in this position. This is not strictly true, however, as it would be magnetized transversely, but its dimensions in this direction being so small compared with its length, the magnetism would be too slight to be detected in the ordinary way.

In the example given, the magnetic field is due to the earth's magnetism, whose lines of force take a nearly north and south direction and tend to thread an iron bar held parallel to them. The magnetic reluctance of the bar, or the resistance which its molecules or molecular magnets offers to an arrangement in conformity with these lines, is overcome or lessened by any means of molecular vibration. In some cases the mere tremor of the earth is sufficient in this magnetic field to permit of this rearrangement. In others it requires a more violent vibration, such as may be caused by heat, by friction, or by a blow, and it not infrequently happens that these agencies must be long continued to produce appreciable results.

The magnetic reluctance of different samples of iron or steel varies not only with their quality and temper, being least with soft annealed iron and greatest with hardened steel, but also with the past history of the bar in question.

It is found that a bar which has once been magnetized in a given direction and demagnetized will more readily again take magnetism in the original direction than in the opposite one, and although two bars may be of identically the same composition and hardness, they will vary in their susceptibility as the stages through which they have passed in the course of manufacture have varied. So that it has been well said that the susceptibility to magnetism of a given bar is the resultant of all the influences to which it has been exposed in and since its manufacture.—*Electricity.*

Improved Storage Cells.

This is the storage battery of the Société Anonyme pour le Travail Electrique des Métaux, the output of whose works at Saint-Ouen, Paris, is at the rate of five tons a day, with a capacity for ten tons. Cells with a total storage capacity for 70,000 lamps are now in use at Paris. The working capacity and durability of these accumulators are sought to be increased without increase of weight or cost. For this purpose the plates are made of grid pattern, with square holes filled in with reduced lead of great porosity. Chloride of lead and chloride of zinc are melted together and the fused salts moulded in cakes of 2 inches square, of desired thickness. The cakes are formed with cross grooves on both sides and a small hole through the center. When cool they are removed from the mould, laid in batches between perforated iron plates and placed in a bath of hydrochloric acid for 15 days. The chloride of zinc is thus dissolved out. The cakes are afterward dried, placed in moulds, and molten lead poured in, forming a framing, the lead also running into grooves on the faces of the blocks and into the small hole—a self-supporting plate of good conductivity being thus produced. The plates are trimmed up and placed with zinc plates between them in a solution of chloride of zinc, which reduces the chloride of lead squares to pure porous metallic lead, the last traces of chloride of zinc being removed by a bath of dilute hydrochloric acid. They are afterward washed several times in alternate pure and acidulated water. The processes of reduction and cleansing are now complete, an examination of the interior of the squares showing the pores of regular structure at right angles to the surface of the plate. The plates are then formed in the usual way by passing currents of electricity, the efficiency of the resultant cells being remarkably high. The ordinary plates made by the Société have a capacity of 10 ampere-hours per kilo. (4·5 per pound). Cells of special type for traction purposes possess the high rate of 19 ampere-hours per kilo. (8 per pound). A remarkable feature is the high rates of charge and discharge. An installation at the Hotel Continental having 55 half-ton cells has an ordinary output of 600 amperes, and on an emergency of 1,200 amperes, at 110 volts, without noticeable fall in voltage, and without detriment to the plates. The largest installation where they are used is that of M. Popp, where 25,000 16-candle power lamps are supplied. There are no less than sixteen sub-stations, all charged from one central generating station. The engines cease running at 4 P. M., the batteries carrying the entire load till next morning. These accumulators have been adopted by the French government after severe tests, and, it would seem, constitute a most important advance in this department of electrical practice.

The Meat Diet.

The attention of the French Society for the Advancement of Science has recently been directed by certain physicians to the evil effects of an excessive meat diet, or of raw, overkept, or bad meat. The ptomaines thus produced introduce poisonous principles in the system, which the kidneys cannot throw off. Inhabitants of cities indulge far too freely in meat, often badly cooked and kept too long; the poor and country population do not often get their meat fresh. Professor Verneuil considers something should be done to remedy this state of things. He points out that Reclus, the French geographer, has proved that cancer is most frequent among those branches of the human race where carnivorous habits prevail.

Cocoanut Butter.

This comparatively new product was at first said to be prepared from the milk of the cocoanuts, but as a matter of fact it is produced from the cocoanut oil, by treatment with alcohol and animal charcoal, which removes the rancid flavor and makes the butter white.

An Edison Patent for Connecting "Tension Reducing" Devices in Multiple Arc.

On Dec. 8, 1891, a patent was issued to Mr. T. A. Edison, entitled "Sytem of Distribution," No. 464,822, which will attract considerable attention, owing to the broadness of the claims embodied in it. The patent was filed June 26, 1882, and describes the method of employing a high tension main circuit extending to a distant point and "tension reducers" located at a distance from the point of supply and connected with the high tension circuit in multiple arc so as to be independent of one another, the lamps or motors on the derived low tension circuit also being connected in multiple arc.

One method of accomplishing this object is described, consisting of secondary batteries or condensers which are charged in series from the high tension circuit and discharged in multiple into the low tension circuit, this being accomplished by means of a revolving commutator.

The patent was the subject of prolonged interference proceedings. Its claims are as follows:

1. In a system of electrical distribution, the combination of a main circuit extending to a distance from the source of electrical energy and having a current of high tension, a constantly acting tension reducer connected with such main circuit by a multiple arc or cross circuit, so as to be independent of other similarly connected tension reducers, and a translation circuit supplied by such tension reducer with a current of lower tension, substantially as set forth.

2. In a system of electrical distribution, the combination of a main circuit extending to a distance from the source of electrical energy and having a current of high tension, a translation circuit, translating devices arranged in multiple arc in such translation circuit, and a constantly acting tension reducer connected with such main circuit by a multiple arc or cross circuit and also connected with said translation circuit, said tension reducer being charged from such main circuit and discharging a current of lower tension in said translation circuit substantially as set forth.

3. In a system of electrical distribution, the combination of a main circuit extending to a distance from the source of electrical energy and having a current of high tension and a translation circuit with an intermediate secondary battery or condenser, and a continuously working commutator throwing all the elements of such secondary battery or condenser together and at the same time rapidly forming a series connection with the main circuit to multiple arc connection with the translation circuit, and back again, substantially as set forth.

4. In a system of electrical distribution, the combination of a main circuit extending to a distance from the source of electrical energy and having a current of high tension, and a translation circuit with an intermediate secondary battery or condenser, a commutator throwing all the elements of such secondary battery or condenser together and at the same time rapidly forming a series connection with the main circuit to a multiple arc connection with the translation circuit, and an electric motor working such commutator, substantially as set forth.

The *Electrical Engineer* adds, the Edison Company claims that the patent covers the placing of converters or transformers in multiple arc.

Small Wire Manufacture.

Says the Providence *Journal:* In Providence diamond dies are made and used at the American Electrical Works. Until means for drilling holes through diamonds were devised, wire was drawn through steel plates, which, however, failed to give satisfactory results. The slightest wear in the hole spoiled the wire, which was made larger at one end of the coil than the other. The steel dies, therefore, had to be handled with great care, and whenever the slightest wear was detected, it was necessary to pound the die and ream the hole out to the size required.

The wire makers of Europe discarded steel dies when they learned how to drill rubies and sapphires. These dies were superior to steel dies, but they lacked the hardness necessary to the most perfect dies. Then diamonds were drilled, and better results were obtained, but the production of perfect wire was not possible until after the imported diamond dies were reamed out. The wire as drawn through them was rough, the inside of the hole not being smooth.

The American Electrical Works enjoys the distinction of having manufactured the only perfect diamond dies used in the United States. About twelve years ago, W. H. Sawyer, who has been connected with the company since 1878, made a number of experiments in drilling the jewels. Trial after trial was made, but the diamond was too hard to be pierced by any of the ordinary methods. It was a long time before he succeeded in drilling the diamond, and it is believed that he is the only man in the country who has been able to produce a perfect diamond die for drawing wire finer than a hair pulled from one's head.

These fine wires are used in making the receiving instruments of ocean cables, the galvanometers used in testing cables, etc. The finest wires in the world are made at the factory, at the corner of Stewart and Conduit streets. The smallest size is two-thousandths of an inch in diameter, but the diameter mostly called for is three-thousandths of an inch. An idea of the fineness of the two-thousandths wire is afforded by the number of miles there are in a pound. One pound of this size if unwound would reach from Providence to Woonsocket nearly sixteen miles, and a pound of the three-thousandths would stretch from the City Hall to the chimney of one of the mills at Lonsdale.

The magnet wires are covered with silk thread, which is even finer than the wire, and is wound with two layers, a process requiring the greatest delicacy, as frequently the tendency is to cover the thread with wire instead of wire with thread. The wires are made of copper and German silver, and are unsurpassed for uniformity of diameter and regularity of size.

The diamonds are set in brass dies without cutting. The foreign wire makers wasted their time and money in cutting the corners off the diamond chips in order that the jewels might be set in a socket; but at the American Electrical Works the fragment is placed in the center of the die, and held in position by an alloy melted and poured around the diamond. This saves time and expense in preparing the diamond for use in wire drawing, and the die is as neat in appearance as if the stone had been cut into ornamental shape.

It is difficult to secure the diamond chips of which the dies are made. The pieces in demand are knocked off the large jewels by the lapidaries and are often used for rose diamonds, that is, diamonds with flat surfaces. A few years ago the supply was abundant, but since the discovery of the process of drilling holes so small that they can scarcely be seen without a microscope, the quantity in the market has been limited.

Electric Lights for Rome, Italy.

A notable example in Europe of water power utilization in connection with electric lighting is afforded by the new electric station now being established at Tivoli, near Rome. There is at this place a large and valuable water power, a portion of which has recently been utilized in the establishment of a large alternating current station of a capacity of 2,000 h. p., intended to supply a portion of the city of Rome with electric light. Water is taken from the Falls of Tivoli by an aqueduct from which there is a pipe line 62 inches in diameter to the wheel station. The entire fall is 156 feet, and the water supply 106 cubic feet per second. The power station consists of three 100 h. p. Pelton wheels which operate direct current dynamos used as exciters. Also six Pelton wheels couple direct to the same number of 350 h. p. alternators which run at 170 revolutions per minute. Each alternator is designed to furnish current at 5,000 volts pressure and 45 amperes. The wheels are governed by hydraulic inlet valves, are worked by a sensitive hydraulic relay which is set in operation by a centrifugal governor. By this means the speed is automatically kept constant, independent of the working of the machine.

The alternating current so generated is to be transmitted to Rome, a distance of 15½ miles, by means of four stranded copper cables, each being 0·05 square inch in cross section, and capable of carrying 120 amperes carried overhead on iron poles placed 114 feet apart, and about 30 feet high, insulated by means of double-shed oil insulators, specially designed for this work by Prof. Mengarini.

A drop of 1,000 volts, or 20 per cent, is to be allowed in these lines. At the far end of the trunk mains the pressure will be reduced by step-down transformers to 2,000 volts, and distributed underground by Siemens cables to secondary centers, at which it will be again reduced to 1,000 volts.

The six machines are all capable of being worked together in parallel, the maximum number of five being used together, and one machine being always in reserve. Two of the exciters are sufficient to supply exciting current to the whole of the dynamos, the third being a reserve.

The Deadly Cold Bed.

If trustworthy statistics could be had of the number of persons who die every year or become permanently diseased from sleeping in damp or cold beds, they would probably be astonishing and appalling. It is a peril that constantly besets traveling men, and if they are wise they will invariably insist on having their beds aired and dried, even at the risk of causing much trouble to their landlords. But, according to *Good Housekeeping*, it is a peril that resides also in the home, and the cold "spare room" has slain its thousands of hapless guests, and will go on with its slaughter till people learn wisdom. Not only the guest, but the family, often suffer the penalty of sleeping in cold rooms and chilling their bodies, at a time when they need all their bodily heat, by getting between cold sheets. Even in warm summer weather a cold, damp bed will get in its deadly work. It is a needless peril, and the neglect to provide dry rooms and beds has in it the elements of murder and suicide.

Chignecto Ship Railway.

Mr. Ketchum, chief promoter of the Chignecto Marine Railway, has notified the Dominion government that an application will shortly be made to the government for some of the subsidy to be payable as interest on the bonds which are to be issued. This, Mr. Ketchum says, would be practically a guarantee that the interest on the bonds will be paid, and would not involve any more expenditure on the behalf of the government than if the work had been completed last year according to contract and the subsidy paid agreed upon. The subsidy to be given by the government is $170,000 a year, payable after the completion of the work in half yearly installments of $85,000 each for 20 years. The work of building the ship railway commenced in October, 1888, and another season's work would finish it. The most difficult and risky part of the work is accomplished, according to Mr. Ketchum. He says that nearly all the earthwork has been completed, the roadbed has been graded, the embankments and foundations made solid, the harbors and approaches constructed, the masonry built firm and solid, and 12 miles of single track laid. About $3,500,000 has already been expended and about $1,500,000 is needed to finish the work. This is an interesting and important project. It is to be hoped the necessary money for its completion will be soon provided.

Treatment of Locomotive Boiler Waters.

At a recent meeting of the Western Railway Club, the subject of discussion was the treatment of locomotive boiler water. The purge which seems to be the most successfully used to remove and prevent scale is composed of caustic soda and soda ash. About one quart, costing one cent, is used in the locomotive boiler for every twelve miles of distance traveled. Mr. Lewis said he had for the last year or more made a practice of using coal oil. When a boiler is washed out, and before it is filled with water, I have a gallon of coal oil poured into it, and as the water rises in the boiler, the coal oil floating on the surface deposits itself on the surface of the iron. There is no chemical action; we know that coal oil is very penetrating; that you can take a block of cast iron of reasonable size and pour a little coal oil on it and it will permeate through that block. My idea about the coal oil is that it will permeate the scale, or go between the scale and the iron, lifting it from the iron, and then the expansion of the boiler, due to heat, will crack off the scale, and it can be removed when the boiler is washed.

Mr. Quayle said he had recently used potatoes. We are using one peck of potatoes, and we find that the impurities of the water seem to come out every time the boiler is washed, in the form of a mushy substance, about the consistency of cream and about that color, only a little dirtier. I have learnt that sorghum is successfully used in stationary boilers as a water purifier. Mr. Gibbs said: Any vegetable substance can be used in a boiler and it will break up the scale, owing to the decomposition of the vegetable matter. The action of every vegetable substance is the same.

Life Saving at Sea.

The recent heavy gales, and some of the catastrophes that have resulted from them at various points along our coasts, should again direct public attention to the curious inefficiency of the appliances which are at present in common use for saving the lives of the crews of vessels that are cast ashore in storms. It need scarcely be pointed out that, where a wind blows violently off the shore, ships, though they may suffer in other ways, do not often come to grief by running aground. That danger is, of course, most threatening when the wind blows strongly from the sea. Yet great part of our arrangements for saving the lives of wrecked crews seem to be based upon the assumption that the dangerous gales come from the land and not from the sea. If not, why do we provide the coast brigade service with the rocket apparatus, and omit to insist that ships shall carry something similar? Even better than the rocket apparatus for this service is a small line-throwing gun. An ordinary brass signal gun, which can be adapted at very small cost for the purpose, will throw a line with considerable precision for a quarter of a mile.—*London Graphic.*

The 100 Puzzle.

We have received a number of ingenious solutions to the above—to so place the ten digits that their sum shall be 100. We submit a number of the same.

(1) $0 + 1 + \frac{3}{2} + \frac{9}{6} + 4 + 5 + 87 = 100.$

(2) $10 + \frac{3}{2} + \frac{9}{6} + 4 + 5 + 78 = 100.$

(3) $0 + 1 + 34 + 5 + 6^2 + 7 + 8 + 9 = 100.$

(4) $1 + 3 + 4^2 + 50 + 6 + 7 + 8 + 9 = 100.$

—*By C. F. Erhard.*

(5) $5 + 10 + 36 + 47 = 98 + 2 = 100.$

—*By W. Donaghy.*

(6) 0 + 97 + 1 + [illegible] + [illegible] + [illegible] = 100. —*By H. S.*

It is to be said, however, that the use of fractions involving division, or of exponents involving multiplication and virtually repetition of the same number, is hardly fair.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM STEERING GEAR. — John Russell, Long Island City, N. Y. In accordance with this invention a steam cylinder is held on suitable supports, which also serve as guides for piston rods, ports leading into opposite ends of the cylinder from a steam chest. The piston rods are each connected with a crosshead carrying a pulley over which a tiller rope extends, the tiller ropes being arranged at each end of the cylinder, so that both ropes will move together, while the steersman operates the wheel just as if he were steering by hand, it being necessary to keep throwing it in order to keep the steam port of the cylinder open for the inlet of steam.

BOILER AND PIPE COVERING.—Robert S. Miller, Wilmington, Del. This is an elastic composition, to be put on in two coats, made of refined or washed kaolin, cow or goat hair, asbestos fiber, feldspar, plaster of Paris, rag pulp, etc., with water. The making and application of the composition, as described by the inventor, varies somewhat, but full instructions are given. It is designed to be fireproof and to cling close where applied without straps, while it is also an anti-rust, odorless and waterproof covering, a good non-conductor, and takes a high polish.

COATING COMPOSITION FOR PIPES, ETC.—This is another invention of the same inventor for a coating or outside finish to various or any special plastic coverings of steam pipes, boilers, and other water-tight and non-conducting surfaces. This coating saves the expense of putting on canvas or other similar outside coverings, and can be washed clean and highly polished, not being affected by changes of temperature.

Railway Appliances.

CAR COUPLING.—Charles J. Knighton, Jr., Birmingham, Ala. The coupling hook, according to this invention, is pivoted within the drawhead, and has a curved rear end, upon which bears a cam-shaped block attached to a rock shaft journaled in lugs or brackets and extending across the end of the car, there being an arm near each end of the shaft on which is a weight. The improvement is designed to afford an automatic coupler of few and simple parts which can be employed with all varieties of link couplers, and with which uncoupling is effected from the sides of the car.

DUMPING CAR. — Paul E. Glafcke, Cheyenne, Wyoming. This car is arranged to dump automatically when the door is unlocked, discharging the load in any desired direction, while the construction is designed to be simple and durable. The wheeled truck has a notched circular plate, between which and the turntable turns a friction plate, the receptacle on the turntable having an inclined bottom and flaring sides, with a door at its open end, while an arm pivoted on the frame engages the notches in the plate. A rod extends from the door to the opposite end of the car, whereby the latch may be released and the door locked in open position from one end of the car.

FLOOR FOR CATTLE CARS.—Ferdinand M. Canda, New York City. This invention provides a floor constructed of alternating high and low boards, forming spaced raised parts integral with the flooring boards, in order to give a proper footing to the cattle, the raised parts thus formed not being liable to be broken off by the cattle, or by the use of the car for carrying miscellaneous freight.

Mechanical Appliances.

GRINDING MACHINE. — Ivor R. Titus, Huntington, West Va. This is a simple and efficient machine for grinding the peripheries of car wheels, and has a rigid frame carrying a spider provided with three guiding rolls, one of which is furnished with a clutch to engage the flange of a wheel and rotate it during the grinding, while the grinding mechanism has a laterally and vertically adjustable wheel. Combined with the grinding machine is a crane for lifting and placing the wheel in the machine, while the turret has a cover which excludes grit and dust from the gearing and the bearings of the shaft.

BALE TIE MACHINE.—Wilbur E. Gladding, Rantoul, Kansas. This is designed to be a durable and efficient machine for making bale ties of wire, also straightening the wire, and the bale ties being rapidly and nicely formed. The head stock of the machine has a bent arm extending above the machine frame, and a revoluble and longitudinally movable shaft is mounted in the stock, on an arm of which is pivoted a split lever adapted to swing over the shaft, while a pair of spring arms provided with guide feet is pivoted in front of the lever.

HAIR WORKING MACHINE. — George A. Williams, San Diego, Cal. This machine comprises a series of swinging needle bars having hooked needles at their lower ends, a series of movable shuttles arranged opposite the needles, a cloth-carrying carriage projecting between the needles and shuttles, and a lever mechanism for simultaneously actuating the needles, shuttles and carriage, with various other novel features. The machine is designed to automatically draw hair through a web of loose cloth or other material, and knot the hair so that it cannot get loose, while it may also be used for securing any fibrous material instead of hair to any suitable web or body.

Miscellaneous.

COIN OPERATED PHOTOGRAPH MACHINE.—Pierre V. W. Welsh, New York City. This machine has a vertically adjustable case to carry the lens, adjacent to which is a mirror, while there is a shutter for the lens, behind and below which are developing and fixing chambers, a swinging plate holder being pivoted behind the lens and above the chambers, at the bottom of which are slotted valves, and a coin-operated mechanism is provided for moving the shutter, plate holder and valves. One whose picture is to be taken moves the case until his eyes appear in the mirror, then drops a coin in the slot, and a clockwork mechanism sets the machine in operation, the picture when completed dropping through a chute upon a tray. An electric light and flash light mechanism are also provided for taking pictures at night.

DENTISTS' RUBBER DAM CLAMP.—Christian A. Meister, Allentown, Pa. The jaws of the clamp to hold a rubber dam in position around a tooth are by this invention provided with simple levers or fingers, not pivoted together as a separate instrument, but arranged to project beyond the spring portion of the clamp, whereby the clamp may be readily opened or manipulated. These fingers may be either permanent attachments to the jaws of the clamp or removable, being in the latter case loosely connected by a light chain, so that they will not be lost.

SIPHON. — Jacob Singer, New York City. This is a simple device, automatic in operation, at all times ready for drawing liquids without requiring pumping or refilling. It consists of a bent tube having at each end a head adapted to form a liquid seal for the ends of the tube, a faucet being arranged in the discharge head to facilitate drawing off liquid by the siphon as desired, while the inlet head has perforations to admit the liquid. The latter head is removed when the siphon is filled with a liquid similar to that to be drawn, previous to placing it in position for use.

SEAL LOCK. — Sidney T. Nickerson, Topeka, Kansas. This invention relates especially to devices for locking and sealing railway car doors, and also applicable to other purposes, as the sealing of chests, room doors, lockers, etc. The ordinary wire and lead seal may be used and a frangible seal, with this improvement, or either may be used separately, and the seal applied in much quicker time than usual. The frangible seal, preferably bearing the initials of the company using it and a number, is more readily seen at night when taking car records than the lead seal, and the seal mechanism cannot be picked or the door opened without breaking the seal.

PERMUTATION PADLOCK.—William M. Brooke, Brooklyn, N. Y. This lock has a two-part case, one compartment of which is open at one side and at the top and has a series of tumblers, while the other has an internal shoulder, the staple to enter the case having one member provided with teeth to engage the tumblers and the other with a spring catch to engage the shoulder. When the locking staple is removed the cover can be easily taken off and the combination changed, but when the staple is in place the tumblers cannot be reached. To insert the staple and fasten the lock it is only necessary to push both members of the staple to place, regardless of the position of the tumblers. The construction is designed to be strong and inexpensive.

LOCK. — Alvin F. Harrison, Greeley, Kansas. In the case of this lock is a keeper plate having an outer and inner recess, a sliding latch bolt and a sliding supplementary bolt with fingers, one of which has a tooth to engage teeth on the lock case, while a link pivoted in the case has its ends pivoted to both bolts. The lock is designed to be simple and durable, operates without springs, and is adapted for use as night lock as well as a day lock, having means for being operated from the inside without a key.

SEWING MACHINE ATTACHMENT. — Anthony B. McDowell, Edna, Texas. This is a grinding attachment which can be quickly made fast to the fly or hand wheel of the machine, for the sharpening of needles, scissors, knives, etc. It has a barrel portion with a central socket into which the hub of the wheel fits and radial spring clamp arms with curved ends to slip over the edge of the wheel, the barrel forming a spindle for an emery or other grinding wheel. The attachment can be quickly put on and taken off, and is simple and cheap in construction.

TROUSERS PROTECTOR.—Oscar Jonach, New York City. This is a shield for the lower edges of pantaloons, adapted to be quickly attached or removed, none of the attaching devices being visible from the exterior, and the cloth fitting snugly to the shield. The shield is semicircular, made of sheet metal, celluloid, hard rubber, or other suitable substance, and has a slight flange at the bottom to extend below the lower edge of the garment, while at its ends are slightly curved needles to enter the hem at the inner sides, and at the center of the shield at the back is a hook, to be also attached to the hem. The natural elasticity of the cloth is not materially interfered with by the attachment of the device.

ROCKING CHAIR. — James T. Mitchell, Monticello, N. Y. This is a platform rocker designed to give a gliding rocking movement to the chair body and dispense with the use of springs. There are segmental surfaces on the lower edge of each side of the chair body and a pair of rollers on each side of the base, one for each segmental surface, while projecting up from the base between the rollers are brackets also carrying rollers traveling in tracks on the chair body. The chair and its platform are by this construction effectively connected, and the roller connection is such that the chair has an easy movement, with a minimum of friction

SAND SCOW.—William Osborn, Duluth, Minn. This scow has hopper-like sand compartments at each end and between them a water compartment in which is located a suction device. The bulkheads which form the end walls of the water compartment have vertically sliding gates, a suction pipe being adapted to be moved through the gateway, while there may be a track on the deck of the scow to support a carriage on which the suction pipe is moved, although the improvement may be applied to a vessel without a deck. The suction pipe is connected to any approved pattern of sand or other pumps.

FLUSHING DEVICE.—John C. Spencer, Anniston, Ala. This is an automatically operating flushing arrangement, connected with the tank supplied with the water necessary for flushing, whereby, as the water rises in the tank, by means of floats, valves, and levers, a portion will be intermittently discharged sufficient to do effective work in flushing. The construction is simple and the action positive, no matter what is the condition of the water in the tank, nor how slow the supply.

METAL SOIL PIPE.—Robert C. Black, St. Paul, Minn. This pipe has a cleaning chamber with annular shoulders at its ends and a lateral opening, a removable cover with a threaded aperture for connection with a test pipe, a detachable plug adapted to close communication between the chamber and one end of the pipe, and various other novel features. The construction is such that the pipe may be thoroughly, quickly and conveniently cleaned, and heavier rods and scrapers may be employed with it than has heretofore been customary.

HOE, PICK AND SHOVEL. — James W. Hurst, Hotchkiss, Col. This is a combination implement, embracing in one device all three of the tools named, the parts being so made that they can be conveniently and compactly arranged, and the tool quickly and easily changed from one implement to another, the devices not in use not interfering with the use of the one it is desired to employ. The lower end of the handle is bifurcated and in it is pivoted the tang of the shovel, the tang extending enough beyond the pivotal point to constitute a pick, and the arrangement being such that the shovel can be locked in position as a hoe, as its tang is fixed in the position of a pick.

HAM COVER. — Wilhelm Wohltmann, New York City. A covering sheet of suitable fabric is arranged to inclose the ham, the sides of the sheet overlapping one another, while a series of buckle straps is arranged on the back of the sheet to close it over the ham. On one end of the sheet is a draw string and on its other end is an elastic to close the ends of the sheet, to protect the ham from dust, insects, etc.

DESIGN FOR A BADGE. — George Bignell, Cheyenne, Wyoming. This is a political design, consisting of a shield and superposed banner mounted on the face of the shield.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3838) C. H. B. says: Supposing there to be a stream of water filling a 36 in. pipe, flowing from 40 ft. to 50 ft. per minute, and having a fall of 300 ft. approximately, what would be the relative power that could be developed by a single undershot wheel, and by a series of overshot wheels, say of 24 ft. diameter, so placed as to utilize as far as possible the entire fall of 300 ft.? A. The total value of your stream as stated is 157 horse power. You can utilize of this power by the best impact wheels about 130 horse power. With an overshot wheel of 24 ft. diameter, you have little or no benefit from the great height, and can realize little better than 15 horse power. With a common undershot wheel, in which you may make the impact from the pressure in the pipe available, you may realize 50 horse power.

(3839) H. A. asks: 1. If there is any-one at present experimenting with calked cast iron pipes for the use of steam. If so, what is the result? A. Cast iron pipe with calked joints is not used for steam at any pressure. It does not remain tight but a short time, owing to expansion and contraction by the heat of the steam. 2. Will a 4 in. cast iron pipe as above stated stand a pressure from 10 to 25 lb.? If not, what is your idea of making use of the said pipes for the circulation of steam? A. The pipe will stand the pressure, but the joints work loose when made with lead. Would stand better, if with rust joints, for a short time. Thin cast iron pipe of this class with rust joints is used for hot water heating when there is but slight pressure.

(3840) J. Q. D. asks: 1. Have locks ever been constructed in the mouth of tidewater streams where the water was not at low tide sufficient for large vessels to navigate, in order to retain a uniform depth of water, and also to prevent the current that so much retards the speed of boats, both going in and coming

out to sea? A. The slack water navigation of streams has been long in use, of which the navigation of the Schuylkill River, from Philadelphia to Pottsville, is a notable example. The Sault Ste. Mary Canal is also an example. Tide locks have also been long used in the United States for ordinary canal purposes, and in England for the largest ships. 2. Is there any geographical reason why such locks could not be built in the mouth of the James River, at some suitable place above Newport News, and thus form a motionless level of over 100 miles, and gain at least 4 ft. of water as against low tide? A. There is no reason that we know of to prevent the James River being made navigable by slack water, except the rights of riparian owners. 3. What is an approximate estimate of miles of navigable streams in this country, that could be so improved? A. There are thousands of miles of streams in the United States that could thus be made navigable as well as a source of power. Railroad competition seems now to be a bar to this class of improvements.

(3841) **N. M. W. asks: 1. What size** and quantity of silk covered magnet wire should be used on a Bell telephone, and to what resistance wound? A. Use enough No. 36 wire to bring the resistance up to 150 ohms. 2. Would No. 32 cotton covered do, and what amount of it, and resistance? A. No. 32 will not answer so well. 3. What number in American or Brown and Sharp gauge corresponds to No. 36 B. W. G. which I have been told to use on my telephones? A. No. 35 American gauge corresponds to No. 36 Birmingham gauge. 4. I have some ⅜ in. by 6 in. steel magnets, very strong. Are they of proper size? A. Yes. 5. My diaphragms are of common tintype plate. Is this proper, or should they be thinner? Diameter of diaphragms, 2⅛ in.; diameter of speaking hole, 1⅛ in. How far from end of magnet should diaphragm be placed? Where can I get very thin iron or steel for diaphragms? A. Tintype plates will answer for diaphragms. You can get thin tintype plates from dealers in photographic supplies. 6. What dimensions are best for bobbin? Distance from diaphragm to bottom of box about six or seven-eighths of an inch. A. It is not very material. Consult SUPPLEMENT, No. 140. 7. What has become of the "House" telephone, which you described in the SCIENTIFIC AMERICAN some years ago? I think you stated that it would be put on the market. A. We do not know that anything is being done with it. 8. How long a line could be operated with above telephone, without battery, and if battery were used, of what kind should it be, and how connected? A. On a line unaffected by induction, you can probably secure fair results for a distance of from two to three miles. 9. When size of wire is given, without specifying, is the American gauge implied? A. Yes. 10. I have some one quart bichromate of potassa batteries, and some of the carbons are broken, and I wish to replace them myself. They are fixed in brass plates, which have raised pieces running across them on each side of carbon. The carbon seems to be fastened in with lead. Please tell me how it is done. Carbons 1⅜ by 6 in. A. The lead is cast upon the ends of the carbons.

(3842) **C. B. says: Can you tell me how** to clean brass rifle shells so that they can be reloaded? When I try to clean them with soda it forms a corrosive substance on the inside and outside. A. The corrosive substance was on the shells at first, the soda only dissolving the acid portions. Try a solution of oxalic acid in hot water for a few minutes; after washing with soda, wipe inside and outside with a swab on a stick and finish with a soda wash.

(3843) **M. S. asks: 1. Can I get the same** amount of power from the simple electric motor, page 498, "Experimental Science," with 6 cells of Fuller battery, as I could if it was made so small as to give its maximum amount of power with 6 F. cells? A. You can always secure the best results by having the motor proportioned to the battery. 2. How much smaller would it have to be made, also how much and what sizes of wire should be used? A. Make the motor about half the size given, and wind it with No. 20 wire. 3. In either case would the 6 cells develop enough power to run a sewing machine? If not, how many would? A. No; six cells of Fuller battery will not run a sewing machine. It will require double that number. 4. How can I, when using Fuller cells cause the motor to run fast or slow, as when running a sewing machine? A. You can vary the speed of the motor by introducing resistance into the circuit or removing it therefrom. 5. My Fuller battery has been set up two weeks and the zincs, which are Leclanche battery zincs, are just about used up. They were amalgamated and the ends immersed in mercury in the porous cups, which are second hand Leclanche porous cups. The solution used was a saturated solution of bichromate of potass, with 10 per cent of sulphuric acid outside porous cup, water inside. The work done by the battery during that time was to light a four candle power lamp one hour and a quarter and to light gas. Shouldn't the zincs have lasted longer? And can you suggest a remedy for the wasting of the zincs? A. Leclanche zincs are too small for the Fuller battery. The zincs should weigh from 1 to 2 pounds each. Use pure zincs and plenty of mercury.

(3844) **J. M. says: 1. Suppose a pound** of lead and the same weight of wood were dropped from a height of two hundred feet at the same instant, how much difference would there be when the lead reached the ground? If a piece of lead and a piece of wood the same size were dropped from the same height at the same instant would there be any difference between them or would one reach the ground before the other? A. There will be a very great difference in the first case, not so much so in the second case. The friction of the air would retard the fall in proportion to the relative weights and bulk. In the first case the weights will be alike, but the bulk of the wood will largely exceed the lead and furnish a larger area to the resistance of the air. In the second case, the size being the same, the difference in weight will give the lead about fifteen times greater weight, while the resistance of the air is the same with both wood and lead. It is only in a vacuum that the fall would be alike.

(3845) **G. W. H. says: Please inform** me if there is, and how to make, a paint to be applied inside a tin vessel to prevent it rusting, vessel to contain rain water? A. Paint the pail with red oxide of iron paint mixed with boiled linseed oil, two coats, dry each in the sun, or if you desire a fine finish use Japan baking varnish of any dark color and bake in an oven at about 260° temperature.

(3846) **W. F. B. asks: 1. Can a low pressure** engine be worked with success receiving steam direct from high pressure engine without steam jacket? A. The two engines as described can be run as a compound engine if properly arranged. 2. What would be the horse power of a compound engine, high pressure cylinder 16×24 in., low pressure 24×24 in., speed of engine 100 revolutions per minute, steam pressure 150 pounds? A. They should develop from 400 to 450 horse power. 3. What is the width of a locomotive fire box and water space when such is inside of frame? A. Width of fire box, about 4 feet 4 inches; water space of legs, 4 inches.

(3847) **S. A. K. says: I have 15 pounds** of water at a temperature of 60° Fah., and add 2 pounds of steam. What will be the temperature of the mixture? Would there be any difference if I add the same quantity of boiling water instead of the steam? If so, why? A. As you do not mention the pressure of steam, which makes some difference in the result, we assume 5 pounds pressure, which will give you a temperature of 205°, while with boiling water the temperature of the mixture will be but 80°. With steam you add the latent heat of steam, or 950° for each pound of steam.

(3848) **J. L. G. asks: Can I construct a** battery which will generate electricity enough to supply three incandescent lights, and also how many cells and what size will I have to use? A. It depends entirely upon the size of the incandescent lights. You can run three or six 20 volt lamps with 11 cells of storage battery, and you can charge the storage battery with gravity batteries, using four cells of gravity to each cell of storage. We do not advocate the use of primary batteries for practical electric lighting.

(3849) **H. asks: 1. What pressure per** square inch would air have if reduced ½ its volume at sea level, to ¼, to ⅛? A. 15 pounds, 45 pounds, 105 pounds. 2. Give formula to find pressure at various stages of compression. A. For isothermal compression the formula is $\frac{P}{V}-P$=gauge pressure. P=absolute pressure of the atmosphere or 15 pounds. For example:

$$\frac{15}{½}-15=15 \text{ pounds gauge pressure}$$

$$\text{and } \frac{15}{⅛}-15=105 \text{ pounds gauge pressure.}$$

(3850) **D. C. S. says: Being an old subscriber** to the SCIENTIFIC AMERICAN, I would like to ask your opinion in regard to the use of a steam boiler in use here; the boiler in question is of steel plate, ⅜ inch thick, 12 feet long, 60 in. diameter, with thirty-nine 3 inch tubes, return, and the take-up is over the furnace doors, and has the old style safety valve with a round iron ball as weight on lever arm. The proprietors when ready to start found the engine unable to drive the mill with the weight at the end of safety valve lever, and so they added a 56 pound pea to same, and yet had to add 4 fire bricks to end of lever before the pressure was able to drive the mill. Some claim this to be dangerous, as the ball weight on end of lever is the full capacity of boiler; with all this weight, the steam gauge only shows 100 lb. pressure, and is all the time giving trouble by leaking, etc., and needing repairs, etc. A. This is an example of the dangerous practices resorted to in order to get more work from a boiler than is due to its safe capacity. The very fact of its leaking at 100 lb. pressure shows that it is overstrained. This is the cause of many boiler explosions, and should not be tolerated by engineers.

(3851) **J. F. asks if an induction coil** can be made with which to light a 16 candle power Edison's incandescent lamp. If so, please give length and diameter of core, size and amount of wire for primary and secondary coils, and number of layers of each. Have 40 jars gravity battery which can be used to furnish primary current. A. An ordinary induction coil will not light an incandescent lamp, as the secondary current generated by such a coil is of very high E. M. F. with low amperage. The induction coils used for operating incandescent lamps, and known as transformers, are designed for converting a current of high E. M. F. and low amperage, into a current of low E.M.F. and higher amperage, capable of heating the carbon filaments of the lamps to incandescence. The only way you can utilize your gravity batteries for electric lighting is to use them for charging a secondary battery, employing the latter for operating your lamps. With your 40 jars you can charge 10 cells of secondary battery.

(3852) **W. F. C. writes: I have a magazine** clipping which I wish to separate, so as to paste both sides in a scrap book. Is there any way to split it and not destroy the paper? A. Cover both sides of the clipping with strong paste, and insert it between two pieces of very strong, smooth paper, making sure to have it attached by every portion of its surface to the pieces of paper. Allow it to dry thoroughly, then pull the stout papers apart; this will split the clipping, and the parts may be soaked off, washed, and pasted in the scrap book.

(3853) **W. A. B. asks: 1. Can you give** me a good remedy for a sprained wrist? I have tried several remedies, such as liniments, arnica and a band around the wrist, but without cure. A. After the remedies that you have already tried, we can only advise you to consult with a good physician. 2. Should a stone fall from a great height, say 500 feet, does it gain in speed until it reaches the ground, or is the speed of the stone the same after it has fallen a certain number of feet? A. A stone falling from a great height will increase its velocity until the resistance of the air due to its area is equal to the weight of the stone, after which it will fall at nearly uniform velocity, but slowly decreasing as the air increases in density.

(3854) **M. J. H. asks: What is the comparative** cost of tin, galvanized iron and copper for gutters, and what is the comparative durability of each? Will they last longer if painted? A. The cost increases in the order named. Copper gutters will outlast tin or galvanized iron many times. All will last longer by being painted every two years. The comparative cost will depend on the thickness of the metal.

(3855) **W. J. says: Our old grist mill** had 6 runs of stones. These stones were 48 inches diameter and ran 160 revolutions per minute, making a fine quality flour. What amount of power would each stone require? How many bushels of wheat should be ground per stone, or what should be the output of the mill in bushels of wheat ground and in barrels of flour, for one day or twenty-four hours? A. Each stone will require 4½ horse power, and should grind 4½ bushels wheat per hour, making a total output of 648 bushels per day of twenty-four hours, with 27 horse power. This does not include power for elevating and bolting, which will require about 4 horse power.

(3856) **J. E. L. says: Could you inform** me (a subscriber) what is the trouble in regard to the successful operation of a compressed air motor? Is it caused by the friction of the valves, pistons, etc., and the lubricating of the same, as this might be difficult? I have thought it might prevent their successful operation. In steam and water engines this is not necessary, viz., lubricating to a great extent, that is, of the parts mentioned. A. Compressed air motors are in successful use in Europe for power purposes, and compressed air is used all over the world for running rock-drilling machinery and pumps in mines. There is no difficulty in their use. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 765, 721, 684, on the use of compressed air for power.

(3857) **J. H. S. asks: 1. What temperature** of air passing through petroleum is necessary to vaporize it? A. Crude petroleum may begin to evolve vapor at 100° F. or less, all depending on the sample. To finish the volatilization a high temperature is needed at the end, and some pitch will be left in the still. 2. What is the highest temperature petroleum gas will stand without ignition, mixed and unmixed, with the proper quantity of air for complete combustion? A. 1,000° to 1,500° F. 3. What heat does petroleum gas produce in burning? A. It depends on the gas or the burner. Theoretically, it might give 4,000° to 5,000° F. Actually, not over half these temperatures should be looked for. In Clark's Gas Engine, $2 by mail, you will find these theoretical points considered. We also recommend Robinson's Gas and Petroleum Engines, $5.50.

(3858) **A. G. S. and A. T. ask concerning** relative merits of shorthand systems. A. It is claimed that Pitman's system is more extensively used than any other shorthand method. We can supply manuals in any system, such as Pitman's "Shorthand or Phonography," 40 cents; *ditto* "Teacher," 10 cents; Munson's "Complete Phonographer," $1.50; Burns "Fonic Shorthand," $1; Graham's "Hand Book of Phonography," $2; Munson's "Phonographic Phrase Book," $2.50.

(3859) **"Danville" asks: 1. What kind** of pith is used in making figures for an ano-kano? Will pith out of corn stalks answer the purpose? A. The best pith for the purpose is sunflower stalk pith. The other piths will answer however. 2. Does the box need to be air tight? A. No. 3. Which side of the leather should go out—the black or the red? A. The natural uncolored side of the leather or kid. 4. How much bisulphide of tin does it take to put in the pad? A. As much as will spread over its surface. 5. What is the illuminating paint made of? A. From calcium or barium sulphide; see our SUPPLEMENT, Nos. 229, 249, 497 and 539, and the SCIENTIFIC AMERICAN, No. 10, vol. 65, and No. 19, vol 65.

H. H. asks for a varnishing ink.—S. E. N. asks for a varnish for rubber overshoes.—S. R. asks how to dye brown.—C. P. J. asks: Please describe fully the manufacture of enamel signs and sign letters.—J. C. S. asks how to silver glass by solution.—E. D. asks for receipts for engine oils, cylinder oil, axle grease.—J. H. B. and C. H. M. ask for furniture polishes.

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column.

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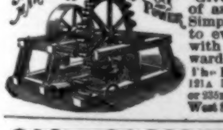

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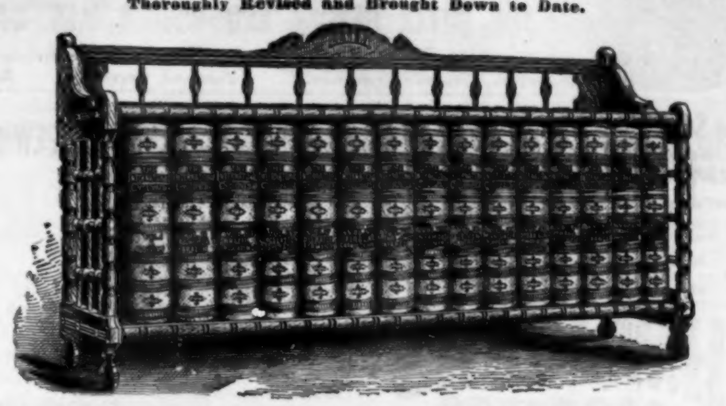

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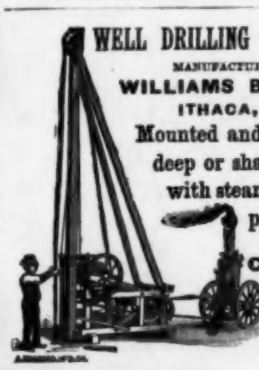

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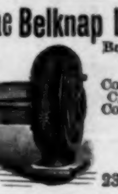

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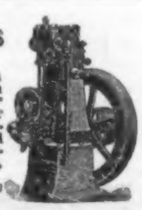

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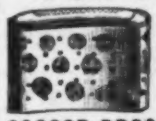

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